PLATING MAGAZINE

plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

BOSTONIA CONDITA. 1630.

"The Old State House"

"200 Ft. Bunker Hill Monument Charleston, Mass."

"Minute Man Statue at Lexington, Mass."

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CONVENTION ISSUE

JUNE · 1961

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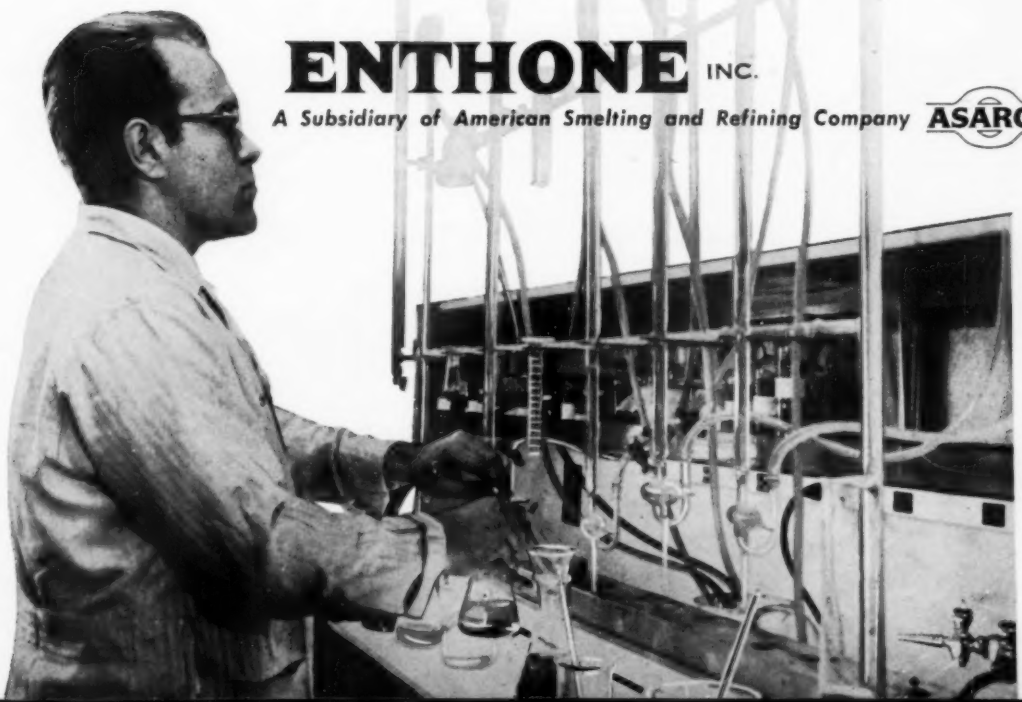

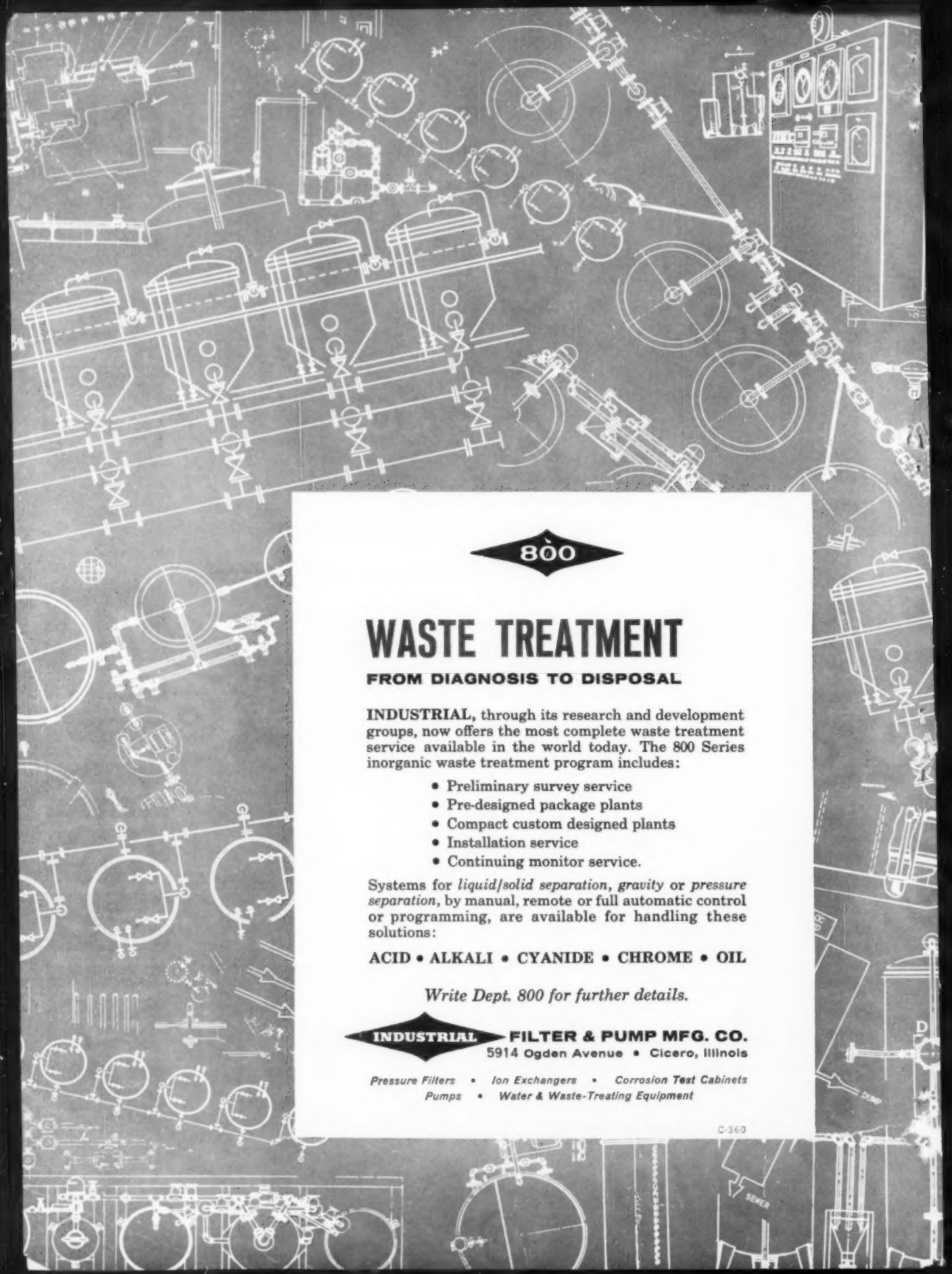

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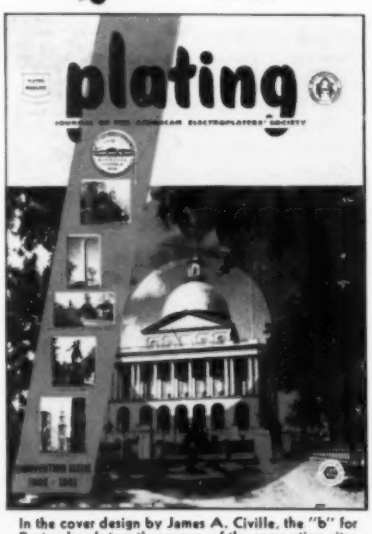

In the cover design by James A. Civille, the "b" for Boston bands together scenes of the convention city.

plating

JOURNAL OF THE AMERICAN ELECTROPLATERS' SOCIETY

CONVENTION ISSUE

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Published by American Electroplaters' Society, Inc. (AES), American Building, 443-445 Broad Street, Newark 2, New Jersey. Phone HUmboldt 2-3400.

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EDITORIAL

AS OTHERS SEE US

METAL FINISHERS have long been so busy perfecting their processes that they have never had time to do much about educating the public, or even the members of other crafts, to understand and respect their skill in coating metals. The essential part played by finishes on metal objects used in daily life is not generally recognized. Experience has shown that creating in the public mind a favorable image of any business or industry can yield great dividends. These are measured not only in satisfaction received through public recognition but also in increased business opportunities. The dividends can even take the form of favorable treatment in interpretation of laws and regulations.

The greatest public utilities, enjoying as they do virtual monopolies in their fields, nevertheless spend large sums in so-called "institutional advertising" programs. These are aimed primarily at presenting a favorable picture of the company to the public. Many corporations in heavy industry which sell no consumer products run expensive advertisements in popular family magazines. Surely, it must be good business to do this.

In the Middle Ages all the trades and professions were known as "crafts". The master artists of each were organized as a guild. The craft guild set up standards of quality of skill and workmanship. It forbade its members to follow certain practices which might have injured the consumer. So well did the guilds handle their public relations that it became a mark of social distinction to be a member. Some of these corporations survive in London to this day as social clubs in which membership is passed down from father to son. In 1954 the principal banquet of the Fourth International Conference on Metal Finishing was held in the magnificent Hall of the Worshipful Company of Fishmongers.

All this leads up to a question of what the metal finishing industry can do to make itself known and understood. Funds for a widespread advertising campaign being out of the question perhaps the next best thing is to reach the members of certain other groups who have a voice in selecting metal finishes, such as parts designers, stylists, metallurgists and mechanical engineers. Individuals responsible for publicity for Branch and Regional annual educational sessions might well consider the possibility of distributing notices not only to AES members but also to members of other technical and design societies.

Why not invite college and even high school students to such meetings? Instead of concealing your connection with our craft, offer to discuss the metal finishing industry at the men's club of your church or at a luncheon of your service club. It need not take a miracle to see ourselves as others see us. The right kind of publicity will do the trick.

W. A. Wesley

President
American Electroplaters' Society, Inc.

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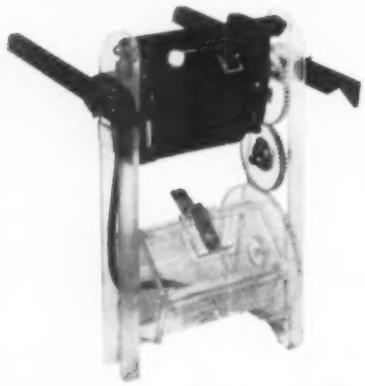

MODEL 2BM

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Hangers Completely Plastic
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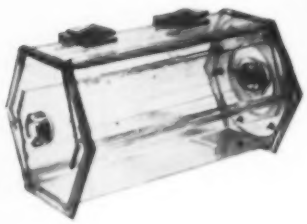
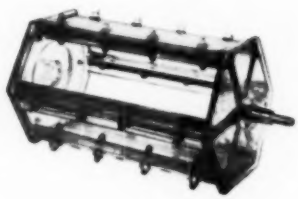


MODEL XNH

New Horizontal Slotted Solid Panel,
Non Perforated, Custom Construction



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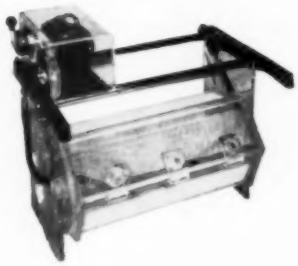

MODEL 2BP8

8" x 18" Cylinder Size
12" x 25" x 21" High Overall Dimension
3/32" Perforations Standard — load 30 lbs.
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LARGE PRODUCTION BARRELS BELT DRIVEN OR GEAR DRIVEN

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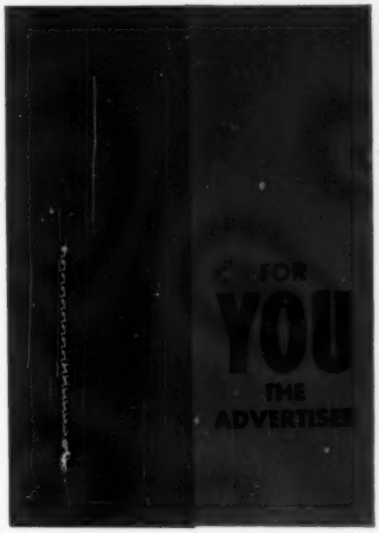

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says JOSEPH T. HINES, Plant Manager, Southern Finishers, Inc., Nashville, Tenn.

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MAIL BOX

DEAR SIR

We read with interest the paper "Factors Producing Tin-Plate Wood Grain" by Higgs and McCarthy in the November 1960 issue of PLATING. Although we have not specifically studied this phenomenon with our circulating electrolyte cell and flow-brightenjng equipment, our general experience is in agreement with the results obtained by the authors.

Recently, during experiments to assess the quality of a tin fluoborate electrolyte, it was found that wood-grain only occurred with 0.50 lb bb coatings and not with 1.0 lb bb tinplate. For a given electrolyte velocity, the higher the current density, the greater was the tendency to produce the phenomenon. Our findings differ from those of Higgs and McCarthy in that electrolyte velocity appeared to have a positive and large effect, the onset of wood grain with velocities of 125, 550 and 800 ft min. being observed at current densities of about 100, 210 and 225 asf. When the electrolyte temperature was increased from 20 to 50C, however, a satisfactory unblemished finish was obtained even on specimens plated under conditions very favourable to wood-grain formation, that is with an electrolyte velocity of 125 ft min, and a current density of 225 asf. All other conditions, including electrolyte temperature, being constant, it appears, therefore, that there is a maximum current density which can be used for a given electrolyte velocity, which will give coatings free of wood-grain.

On the subject of the mechanism of the phenomenon the patterns produced on the two faces of a specimen are mirror images and we are in general agreement with the basic idea that the pattern in fact is a contour map of the steel surface representing local variations in thickness of the steel. It seems rather improbable, however, that the crystal structure of the plated layer of tin can influence the final appearance of the product since the tin coating passes through an intermediate liquid state which one would expect to completely destroy the original structure of the electroplated deposit.

The wood-grain pattern also is found to exist through the thickness of the layer of $FeSn_2$, but microscopic examination of oblique sections at high magnification has not revealed that any differences in structure or thickness of the $FeSn_2$ exist between the bright and dull regions of a wood-grain pattern.

C. J. THWAITES
M. G. COLLINS

Tin Research Institute,
Perivale, Greenford
Middlesex, England

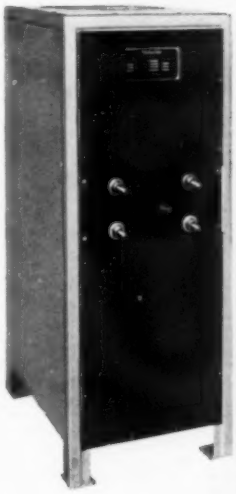
DEAR SIR

The effect of circulation speed on wood grain production which Thwaites and Collins report (i.e., increasing circulation speed decreased wood grain) is what we had expected to find, but, as noted in our paper, our results were not consistently in this direction. The data to date indicate that, in general, any manipulation of plating variables which tends to decrease the supply of tin ions at the cathode will tend toward wood grain production.

In regard to whether the structure of the tin prior to melting can affect the appearance of the tin after melting (i.e., whether it can affect wood grain production), we believe that the crystal structure or grain size might very probably affect the manner in which the tin melts; however, the mechanism by which this might happen has not been determined. We do know that we can eliminate all the variables in the steel base, in the cleaning procedure, and in the melting procedure and produce or not produce wood grain by manipulating only plating variables. We know that manipulating these plating variables changes the grain size of the matte deposit. By a process of elimination, therefore, it appears that the primary cause of wood grain must be associated with the structure of the matte deposit. It should be possible to prove or disprove this by using electron microscope and X-ray diffraction techniques to examine wood grained samples produced under various conditions. These examinations will hopefully be conducted when time permits.

R. F. HIGGS
J. A. MCCARTHY

United States Steel Corporation
Monroeville, Pa.



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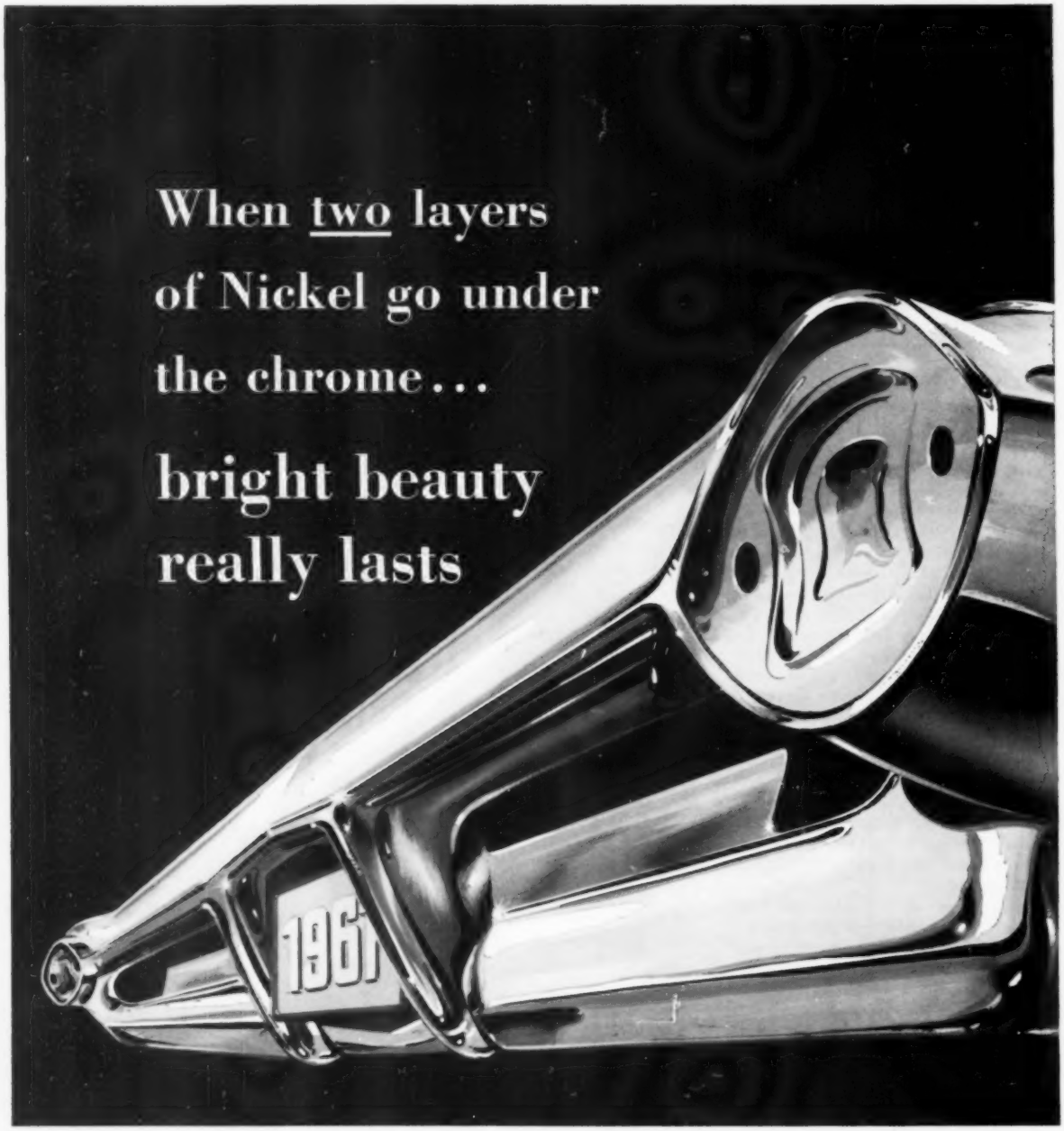

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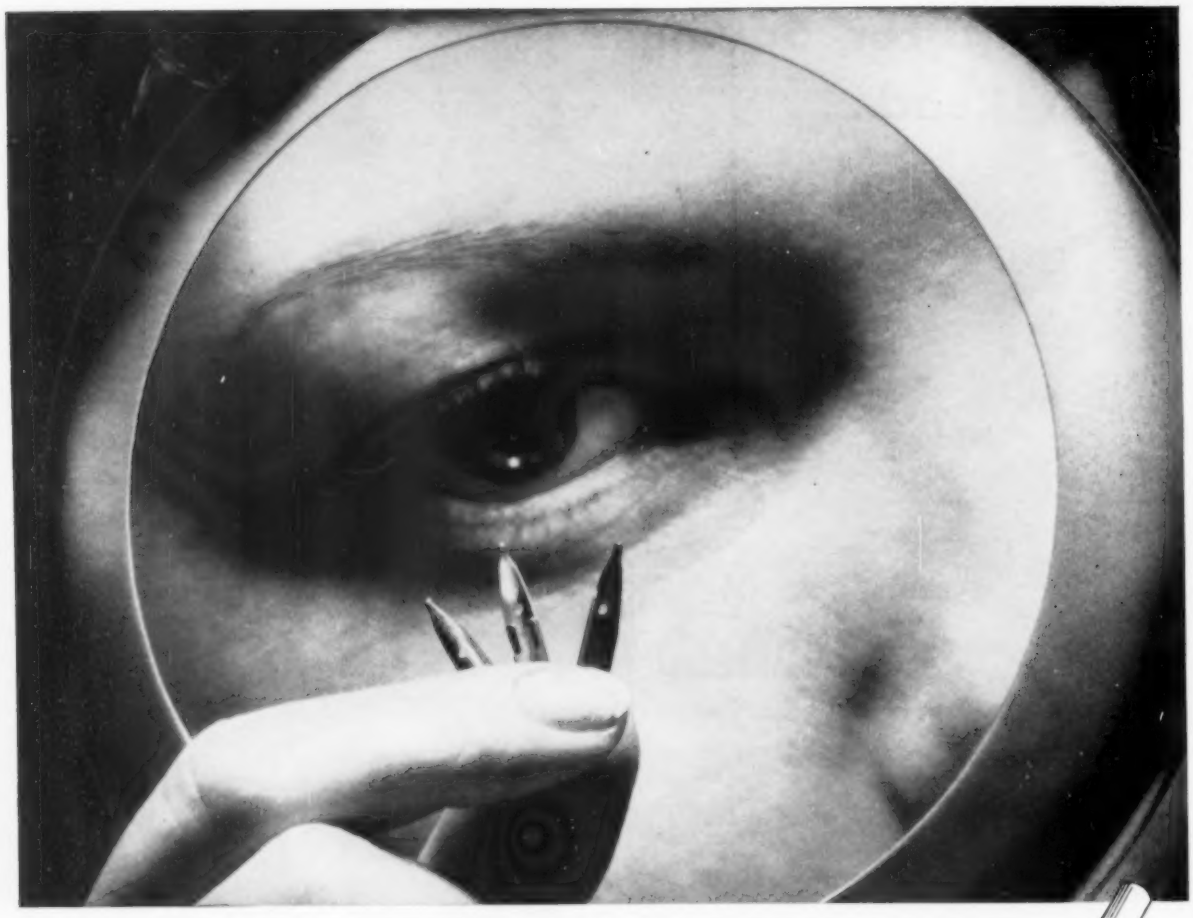

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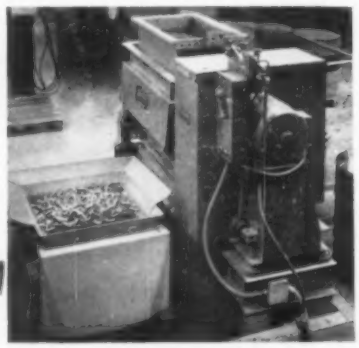

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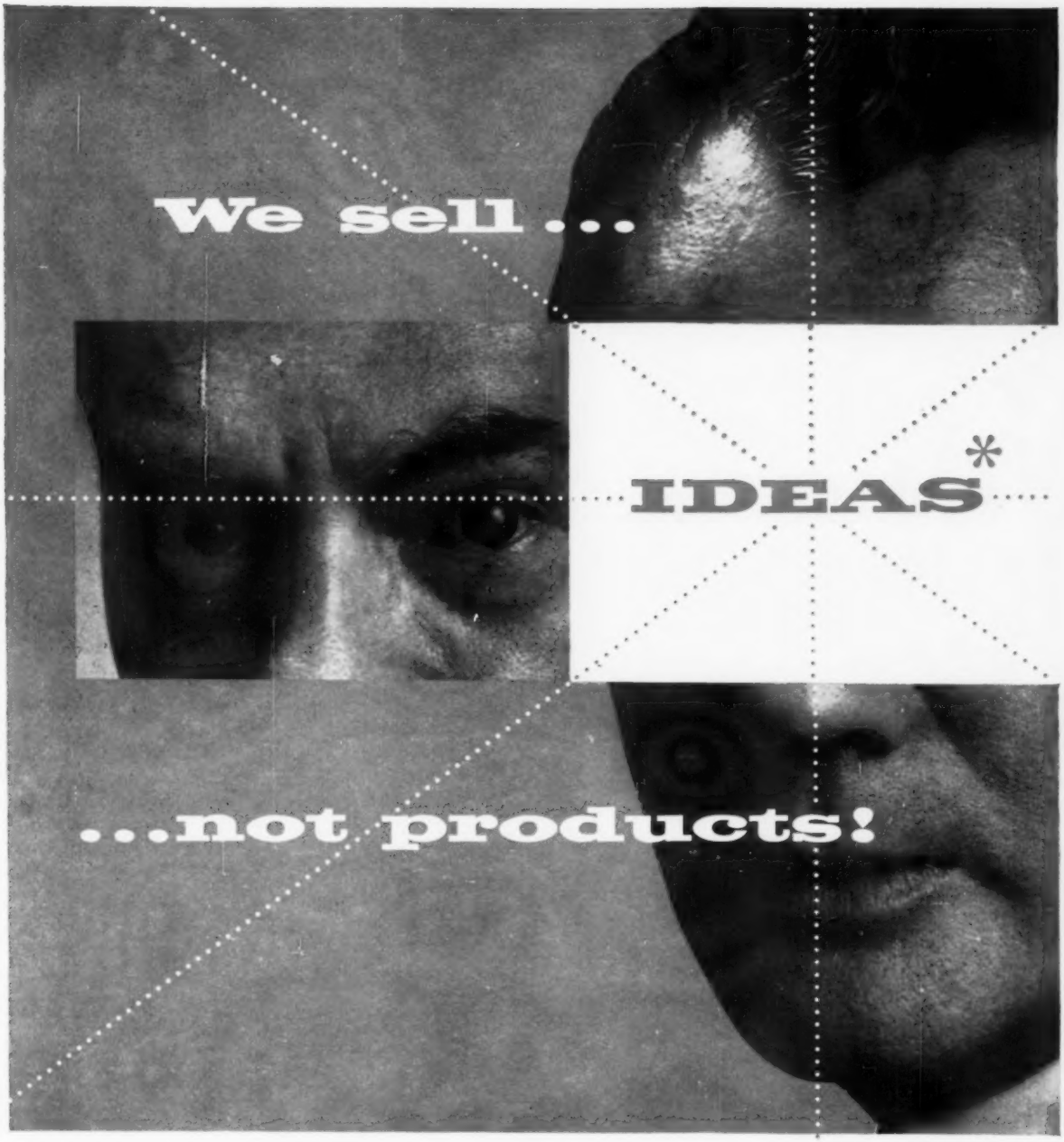

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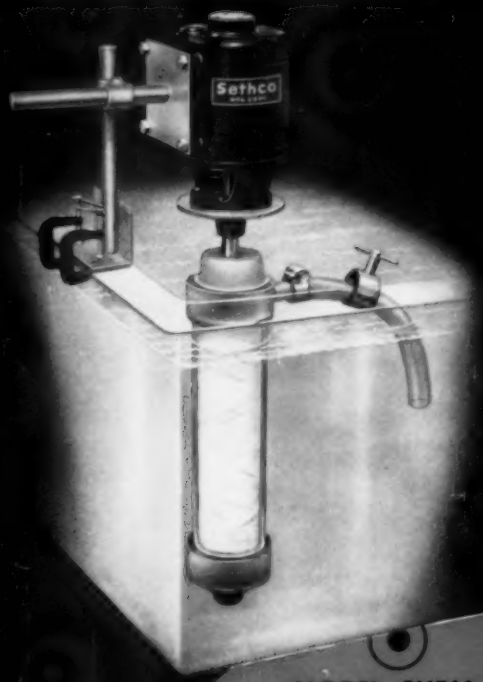

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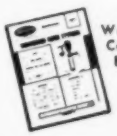

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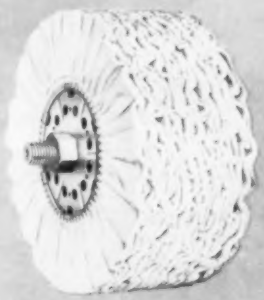

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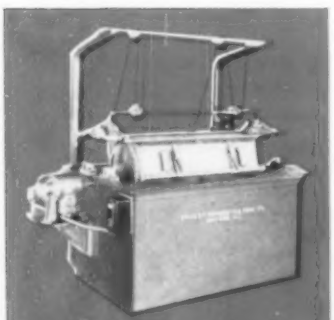

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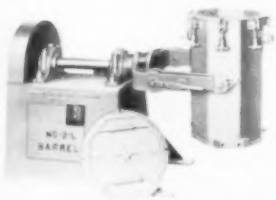

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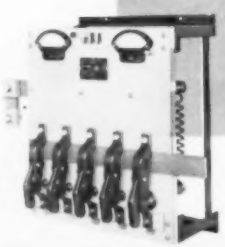

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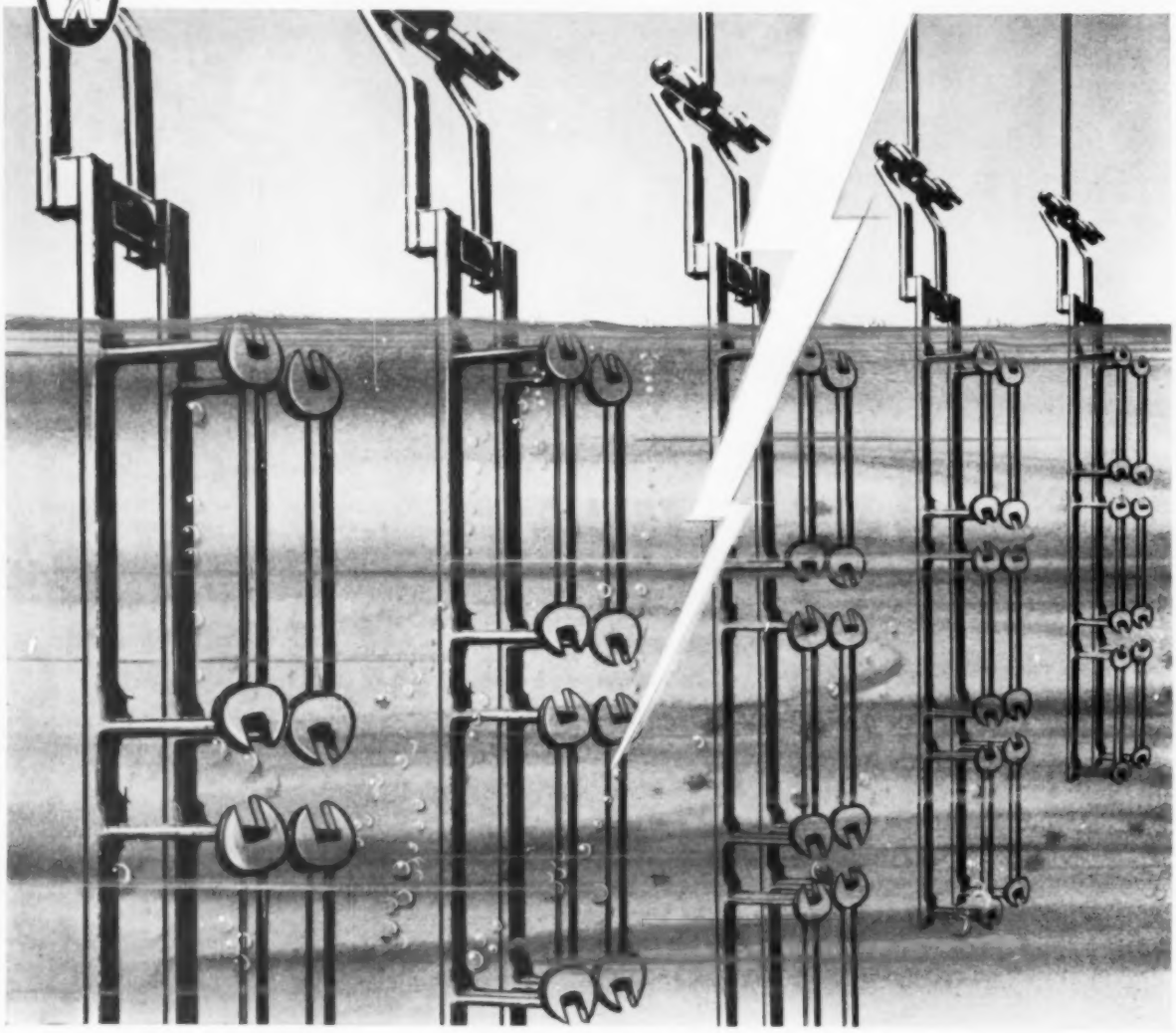

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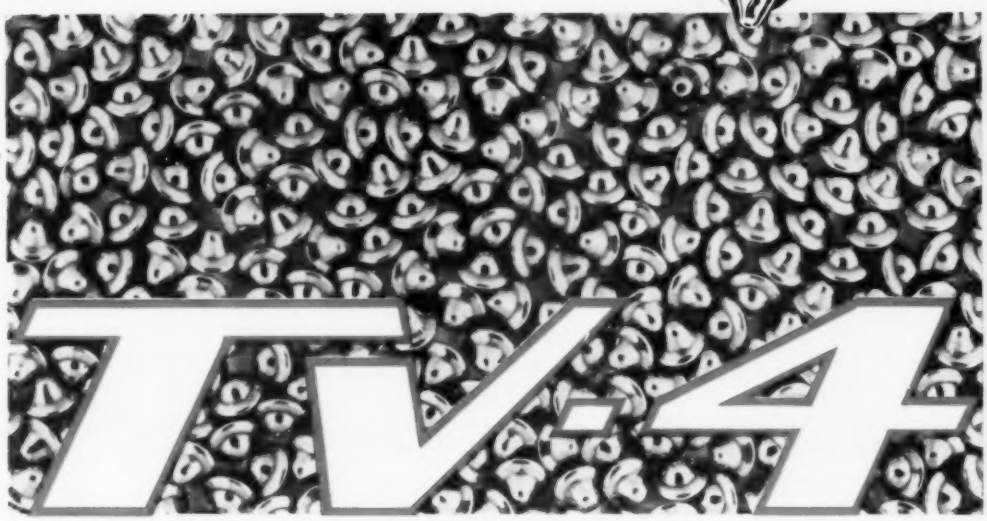

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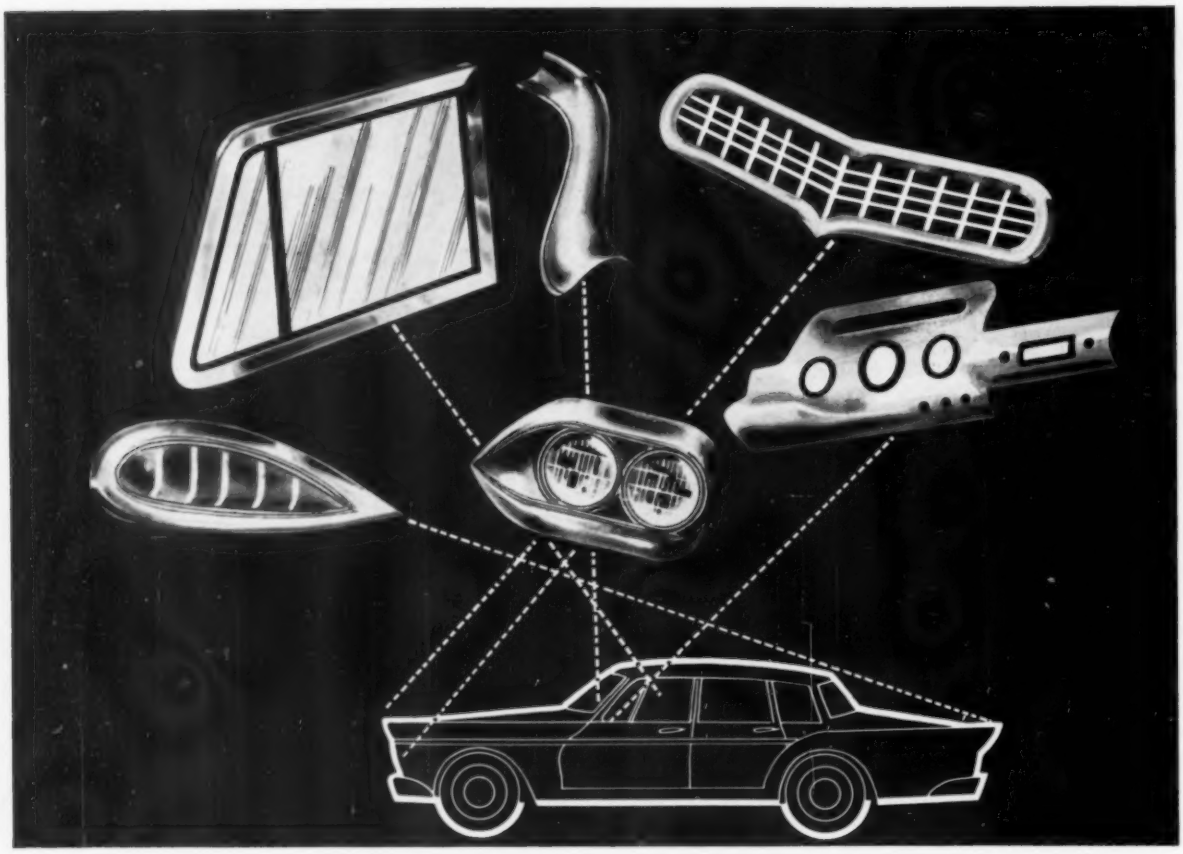

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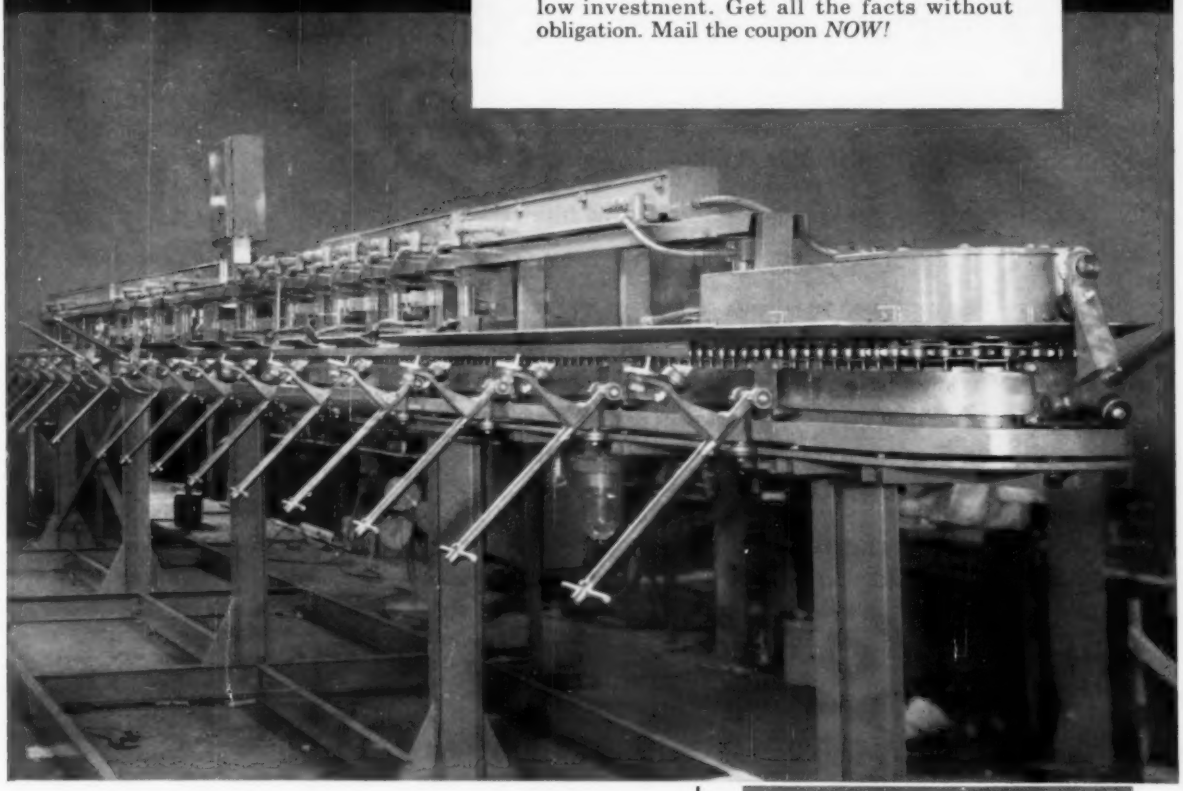

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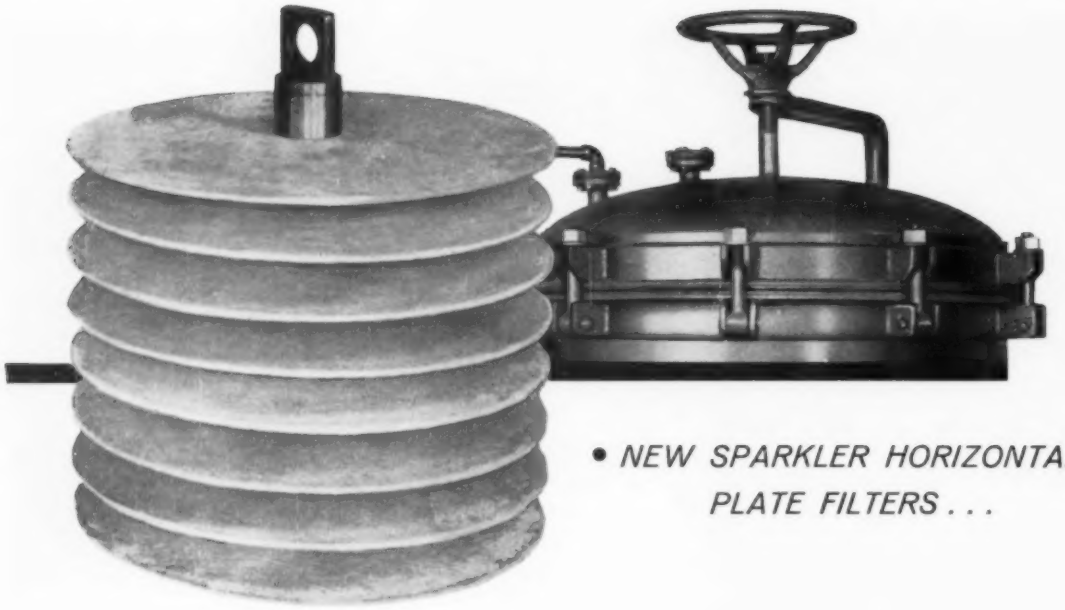

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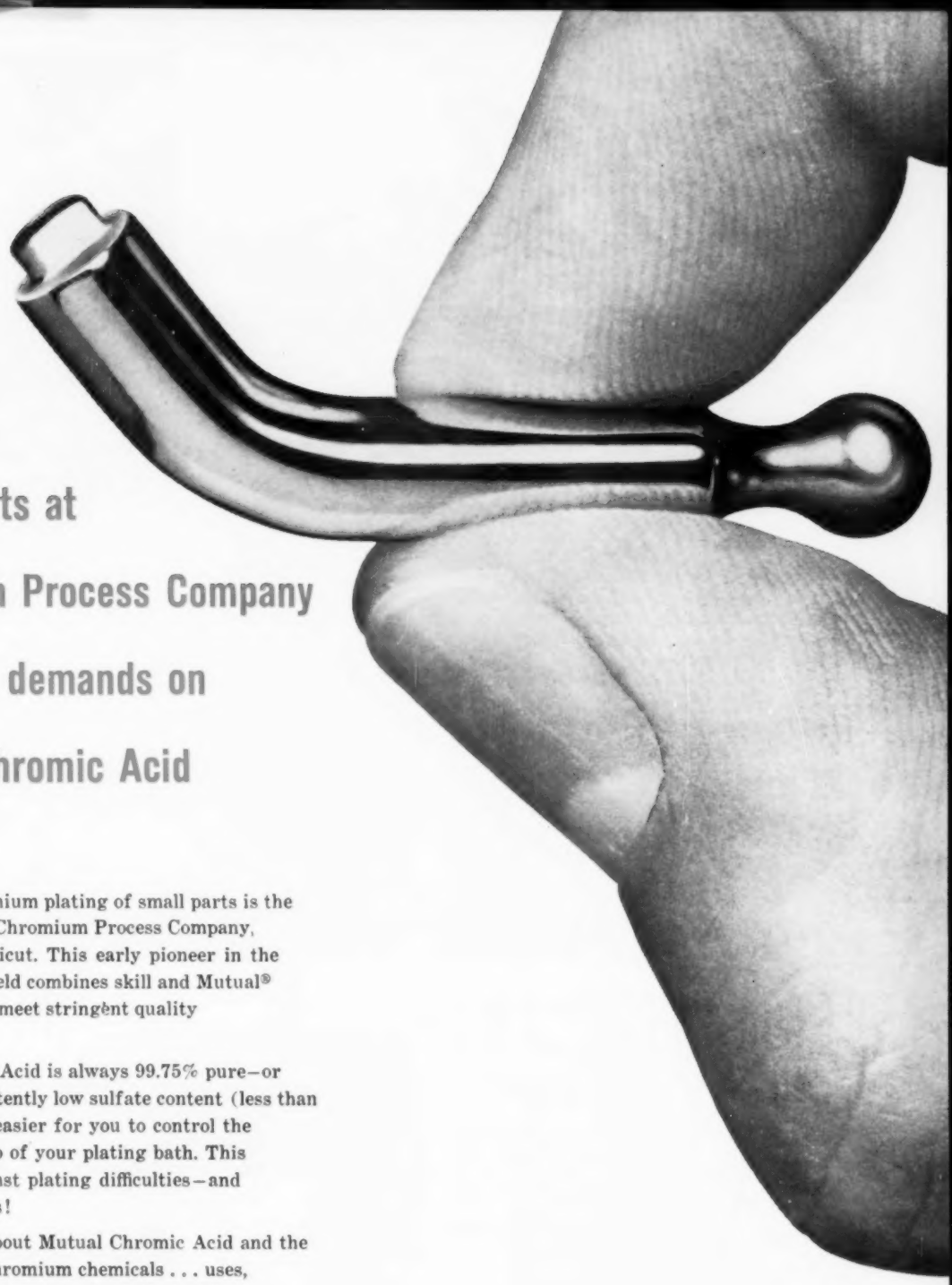

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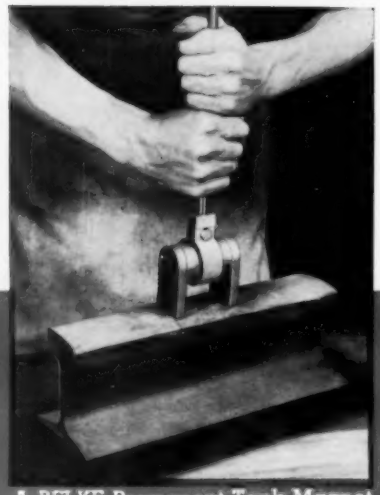

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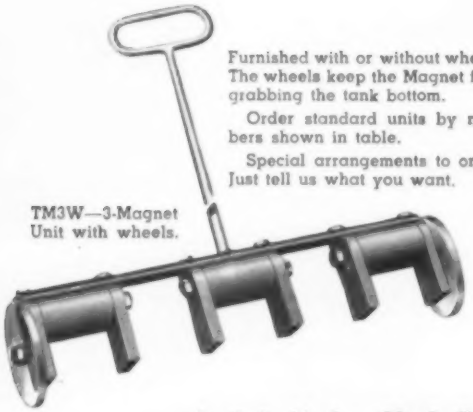

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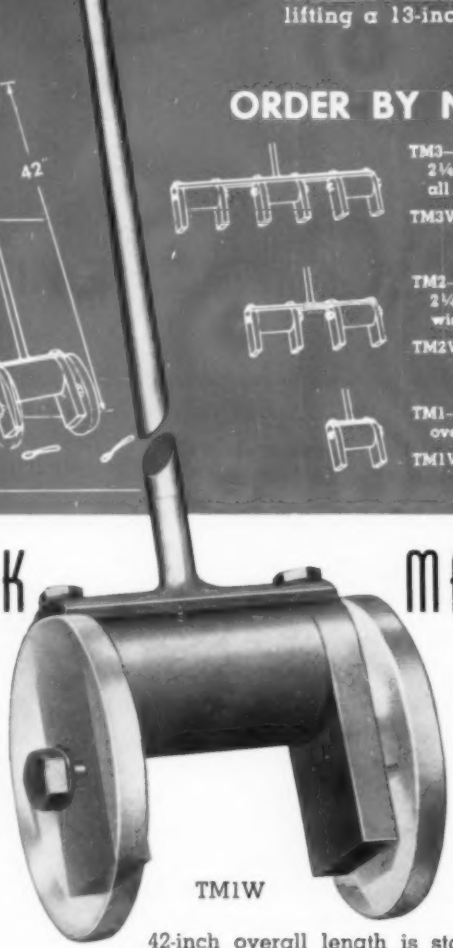

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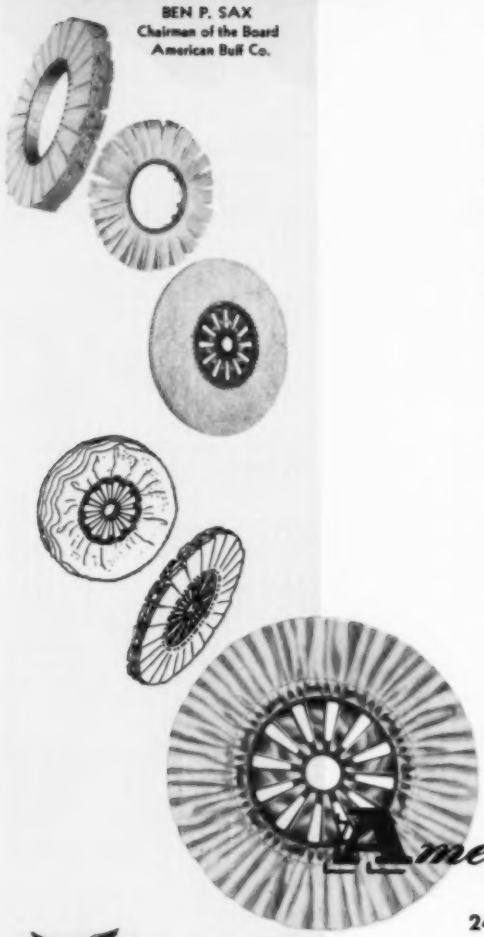

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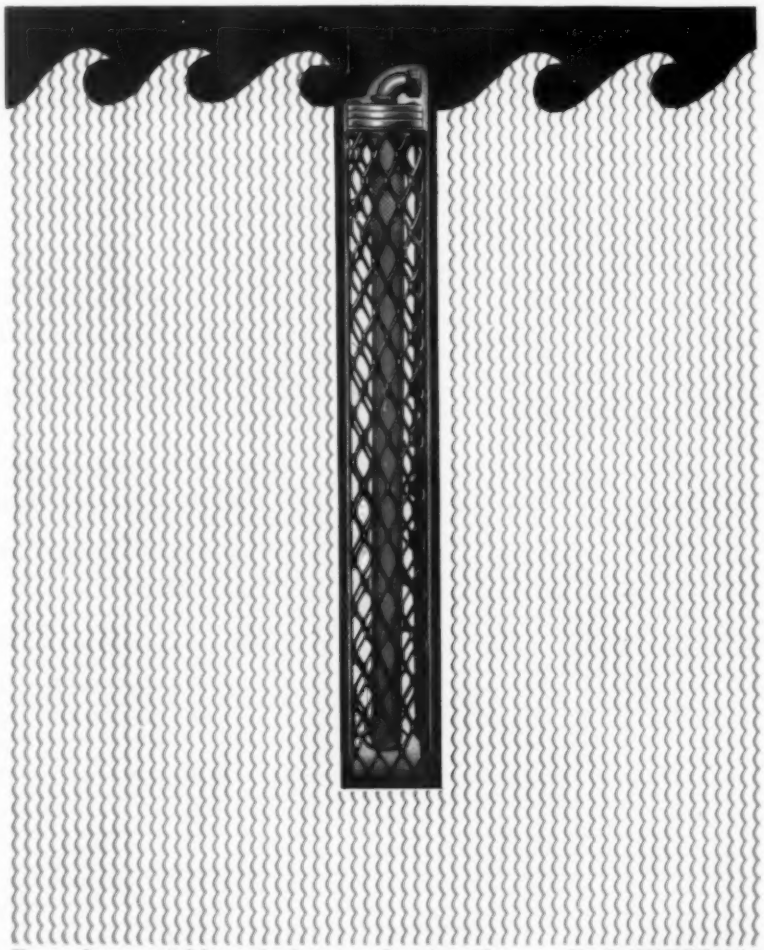

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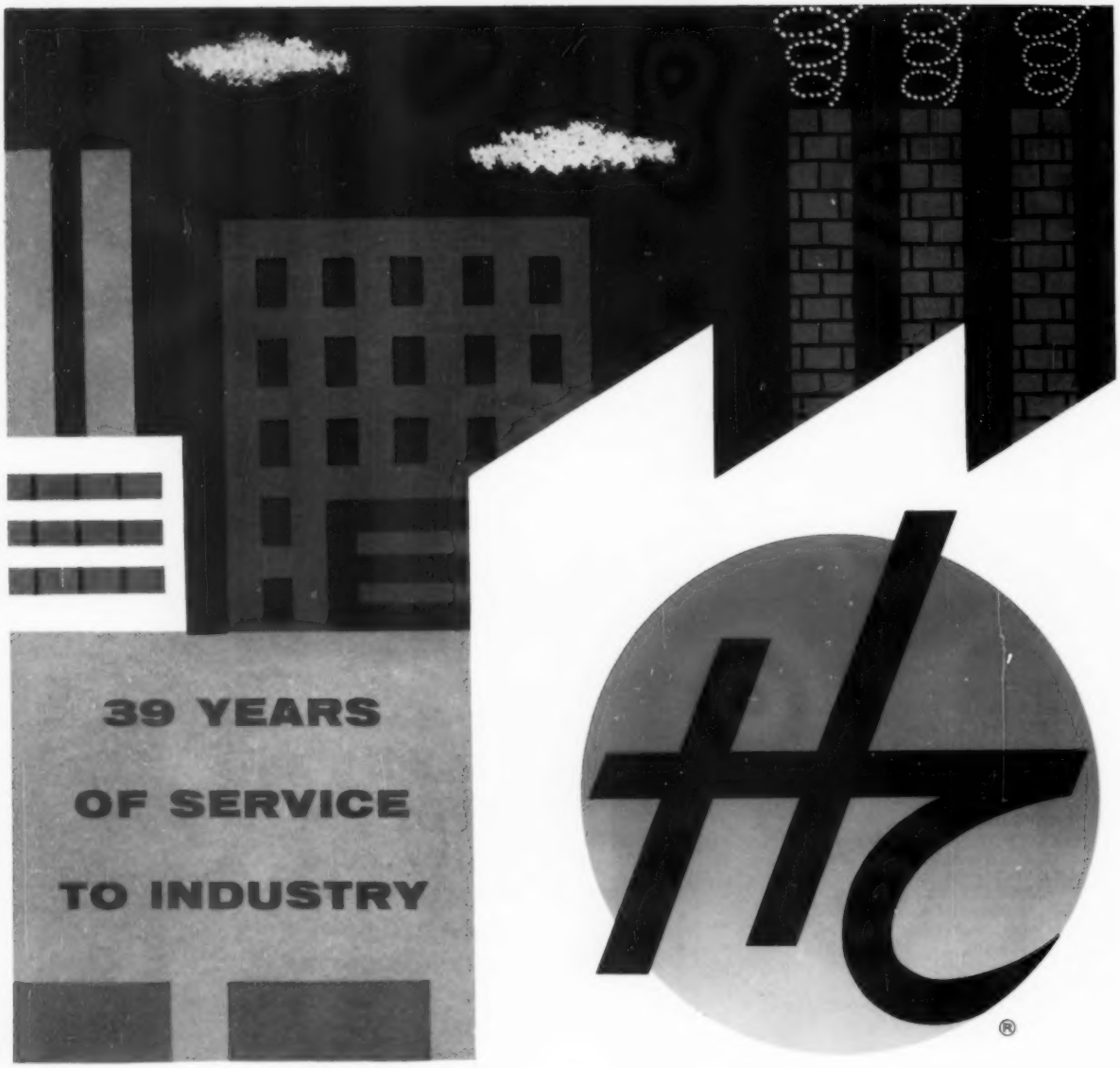

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♦

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♦

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♦

Under the active planning and supervision of the AES's Editorial Board itself, the Educational Sessions were programmed for the AES by Host Branch Educational Chairman Earl W. Arnold and his Co-Chairman, David F. Seymour, with Dr. Harold J. Read of Pennsylvania State University, a special member of that Los Angeles Branch Committee, responsible for the "Hydrogen Embrittlement in Metal Finishing Symposium."

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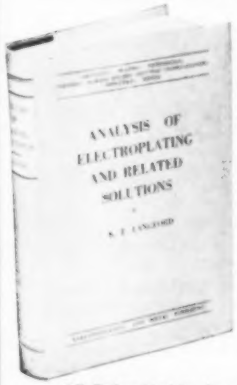

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The unique book contains the full text of each of the 43 technical papers on electroplating, metal finishing, organic coating and allied arts by experts of nine countries, including the United States, England, Canada, Australia, France, Germany, Holland, India and Italy, delivered before the Fifth International Conference on Electrodeposition and Metal Finishing, educational sessions element of the AES's Golden Jubilee Convention held in Detroit, Michigan, June 15–19, 1959.

Spanning some 400 pages (by far the largest annual TECHNICAL PROCEEDINGS ever published by the AES in its half-century lifetime), this 1959 edition also includes, among other data, a day-to-day log of the Golden Jubilee Convention; a section on the AES Scientific Achievement Award and on other AES technical and scientific awards and honors bestowed at the Golden Jubilee Convention; a full listing of the Boards and Standing and Special Committees that served the AES during its Fiftieth Anniversary year, and a complete AES Branch Directory.

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GREETED by the President of the United States, the AES was welcomed to Michigan and Detroit by Governor G. Mennen Williams. The entire week of the AES's Convention, Exposition and International Conference was proclaimed by Detroit's Mayor as "AES GOLDEN JUBILEE WEEK IN DETROIT."

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UNDER the supervision of the AES's Editorial Board, in collaboration with the International Council on Electrodeposition and Metal Finishing, the International Conference was planned for the AES by AES Past President Walter L. Pinner, Chairman of the International Council. His Committee included Dr. T. P. Hoar, Dr. Simon Wernick, A. W. Wallbank, R. A. F. Hammond and George Gardam of England and Myron B. Diggin, Dr. Walter R. Meyer and Dr. Richard B. Saltonstall of the United States.

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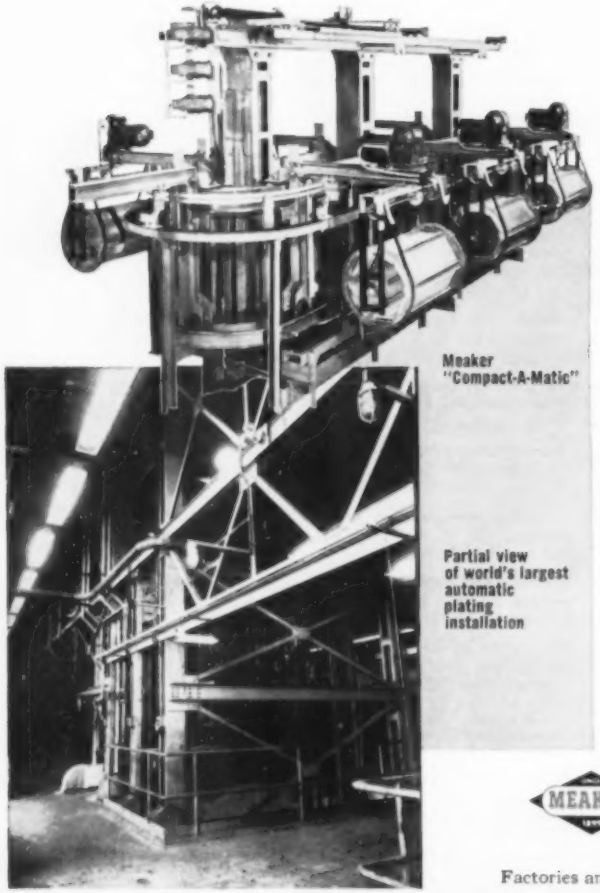

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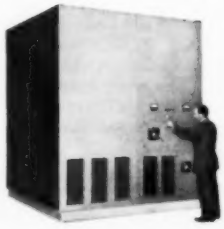

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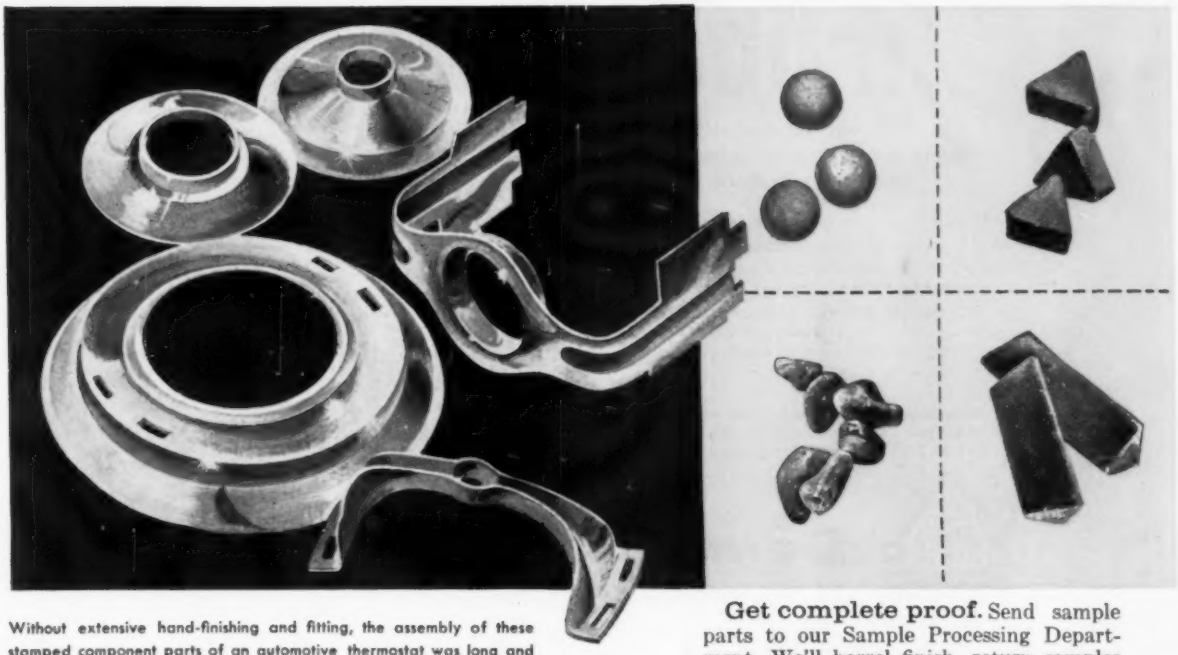

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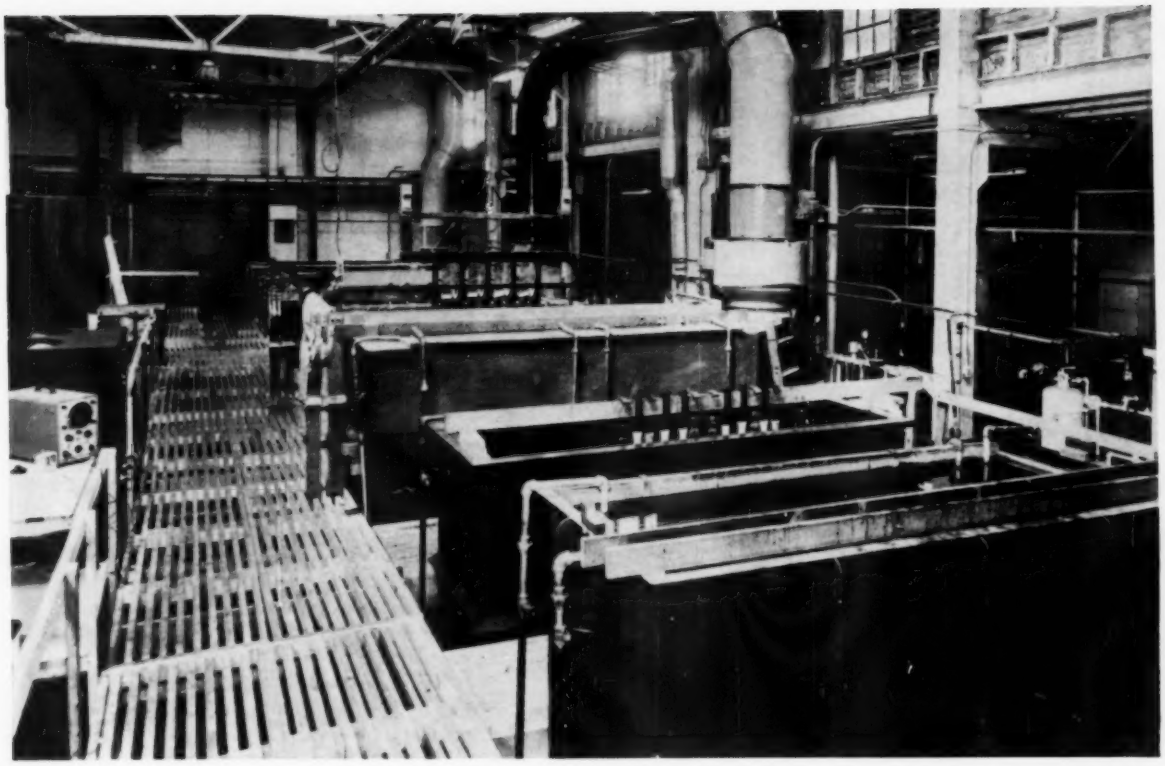


Fig. 1. Photograph of pilot plant for chromium plating; a 10,000-ampere installation. (Courtesy Standard Products Company, Cleveland, Ohio.)

ELECTROPLATING CHROMIUM DIRECTLY ON ALUMINUM

by **CHARLES L. FAUST, GLENN R. SCHAER and DONALD E. SEMONES***

ABSTRACT

A chromium-plating process is described using direct current of a nature heretofore considered unsuitable for practical plating. The electrodepositing current is related to the chromium hydride mechanism of deposition for providing relatively soft chromium of sufficiently low stress for direct deposition on aluminum. The chromium has lustrous sheen and needs color buffing only to bring to full brilliance or can be plated with bright nickel (instead of coloring) and with the same chromium which is mirror bright over bright nickel plate. Also, the bright chromium is free from porosity and from cracks at thicknesses affording significant increase in corrosion protion as shown by corrosion in outdoor, CASS and Corrodkote exposures.

INTRODUCTION

A NUMBER OF PROCEDURES are known for electrodepositing chromium on aluminum. All relate to different chemical treatments to prepare aluminum. Most procedures require depositing another metal before chromium plating, and the chromium is deposited from a chromic acid-type bath. The differences among these methods are due to variations in chemical conditions.

Relatively little work has been done on the electrical circuitry relative to the mechanism for chromium plating. The literature has discussions on d-c sources and comments on problems encountered if the current is interrupted during plating. The general conclusion is that any abnormal fluctuations in current prevent deposition of a satisfactory chro-

* Battelle Memorial Institute, Columbus, Ohio.

Fig. 2. Photograph of aluminum parts chromium plated in quantity at the plant.

mium plate. References can be cited on these points. However, this paper, rather than commenting further on what cannot be done, will report on successful use of fluctuating d-c to obtain unusual results for chromium plating on aluminum.* The success is discussed on the basis of the chromium hydride hypothesis proposed by Snavely.[1]

The data and discussion in the present article are based on the initial laboratory work. These early results showed exceptionally good adherence of the chromium plate on aluminum. This plate was smooth and semibright. For full brilliance, buffing was needed but was accomplished in 10 to 18 seconds on a swing-stand lathe. This time compares with that for buffing of semibright nickel. The plate was much easier to buff than stainless steel, and appears practical for parts of simple shape.

Corrosion performance with plate as thin as 0.15 to 0.3 mil was unexpectedly good in 5 per cent salt spray, the customary test for aluminum. During this preliminary work, CASS (copper acetic acid salt spray) and Corrodkote tests came into use. Data are presented on exposures of chromium-plated aluminum in those tests and one year outdoors at Columbus, Ohio, and Kure Beach, N. C.

Because of the inherent smoothness of the chromium and its good adherence to aluminum, bright and duplex nickel plates 0.2 to 0.8 mil thick over the chromium developed full brilliance. With a final chromium plate 0.025 to 0.050 mil thick, a triplate resulted to give exceptionally good corrosion performance as will be seen in the discussion to follow.

Although the following data and discussion are based largely on the initial laboratory work, aluminum items, multiply racked to total 20 square feet per load, have been plated successfully for months in a pilot plant with two 1500-gallon plating baths and 10,000-ampere capacity. A view of the plant is shown in Fig. 1 and a photograph of chromium-plated aluminum items is shown in Fig. 2.

THE MECHANISM OF CHROMIUM DEPOSITION

According to Snavely,[1] hexagonal chromium hydride is electrodeposited at the cathode from chromic acid electrolytes. This "alloy" is thermally unstable and decomposes during or after its deposition. Decomposition is faster as the temperature is increased. Regardless of when the decomposition occurs, the deposit shrinks in changing to chromium metal (body-centered cubic crystal structure) and hydrogen atoms. The shrinkage causes the well known and said-to-be-inherent crack pattern of chromium plate.[1, 2] No such crack system can result if the decomposition occurs simultaneously with electrodeposition of the hydride.

Attention has recently been directed to crack-free bright chromium plate for use over bright nickel.[3–5] Such chromium plate is deposited at high-enough temperature as to be nominally crack-free. This condition indicates that decomposition occurs during deposition, either resulting in no cracks or in filling of the cracks by electrodeposition of chromium into the voids. Even so, the plate appears to be under some stress, because when these crack-free plating procedures are used for plating directly on aluminum (meaning no intermediate metallic coating operation, such as zincate dip, cyanide copper, or nickel) the chromium tends to crack and exfoliate at edges, corners, and regions of relatively high current density and thicker plate. Thus, we might conclude that although the effect of chromium hydride deposition has been notably minimized, it is still there. Avoiding the conditions of hydride formation has been sought by using higher temperatures.

The opposite approach is to provide conditions such that chromium hydride can be deposited and can decompose to provide chromium plate without cracks or stresses. A mechanism for accomplishing such a result is proposed in the following discussion.

For purposes of discussion, the chromium hydride is an alloy referred to as CrH_x, a unit of which is electrodeposited by discharge of chromium and hydrogen ions at the cathode surface in a manner analogous to the discharge of ions of any metal to become an electroplate. Therefore, CrH_x is electrodeposited unit by unit in the same sense that we electrodeposit nickel, or iron, or copper, etc., atom by atom. The CrH_x unit deposits at a site on the basis-metal surface according to surface-energy relationships as would a metal atom deposit. However, there is a significant difference. The CrH_x unit is thermally unstable and decomposes in some finite time.

The initial CrH_x layer, which has been in existence longer than any overlaying layers, will decompose with contraction that causes any overlaying layers to crack. Therefore, deposition current should be supplied under conditions for an "on time" (deposition period) when one layer of CrH_x can be laid down and for an "off time" (period of no deposition) when the CrH_x can decompose without affecting any CrH_x that is deposited later. This could be accomplished by incompletely covering the basis metal with CrH_x no greater than one unit in thickness, waiting for the decomposition to occur, plating another monolayer of CrH_x, interrupting the current so decomposition can occur, and so on. The result of this action should be a crack-free chromium plate, because there is never an unstable layer being covered by a succeeding layer. The chromium-plating mechanism is hypothesized to involve four reactions as follows:

Reaction 1. During "on time," Cr^{+6}-containing complex ions are reduced and chromium is codeposited with hydrogen to form the units of unstable hexagonal chromium-hydrogen alloy, referred to as CrH_x.

Reaction 2. During the "on time," CrH_x deposition is accompanied by copious hydrogen gas (molecular form of hydrogen) the result of which is to raise the *p*H of the plating solution immediately adjacent to and in contact with the cathode surface.

* This new chromium plating process will be known as DURAMIR, which is the trademark of General Development Corporation for whom the process is being developed. The DURAMIR process has been exclusively licensed to Diamond Alkali Company for further development and commercialization.

Reaction 3. During "off time," CrH_x units decompose into chromium and hydrogen atoms. The chromium atom takes a position in the structure of body-centered cubic chromium metal electroplate. When surface units of CrH_x in contact with the plating bath decompose, the hydrogen atoms combine to form molecular gaseous hydrogen which escapes. Any CrH_x unit that is completely covered by CrH_x and thus not in contact with plating bath, also decomposes, but at some later time, to body-centered cubic chromium and atomic hydrogen which cannot escape and remains occluded to cause stress.

Reaction 4. During "off time," diffusion into the solution interface at the cathode surface tends to restore the *p*H to the value of that of the bulk of the plating bath.

According to the above reactions, and in particular, Reaction 3, if CrH_x units build on top of other undecomposed CrH_x units, the basis is laid for cracked, stressed, and hard chromium plate of the conventional d.c. processes. However, by controlling the electrodeposition rate relative to the decomposition rate of chromium-hydrogen alloy, soft crack-free and unusually protective chromium plate is attained.

The rates of Reactions 1 and 2 are directly proportional to current density and current efficiency of chromium deposition. Current efficiency, in turn, is controlled by temperature, bath composition, current density, and other variables well known in electroplating. The rates of Reactions 3 and 4 are controlled by temperature and bath composition. Maximum "on time" will be defined by Reaction 1. Maximum "off time" and minimum "off time" are defined by Reactions 3 and 4.

In a chromic acid plating bath, the cell (chromium-plated aluminum/chromic acid/lead dioxide-covered plating anodes) has a voltage of about 1.8 volts, tending to dissolve the chromium-plated aluminum. Therefore, an "off time" to allow CrH_x to decompose must provide enough direct current to prevent dissolution of chromium-plated aluminum, but not at enough voltage to deposit CrH_x. Also, after an "off period," plating current will not flow until at least the applied voltage exceeds this back emf of about 1.8 volts. Chromium deposition is according to the voltage wave form shown in Fig. 3.

At the start of "on time" hydrogen evolution is the first reaction which takes away hydrogen ions from the cathode film and causes its *p*H to increase. Chromium does not deposit until a finite current density at decomposition voltage is attained. Once started, the rate of CrH_x deposition is proportional to the product of current density (CD) and current efficiency (CE) of Cr atom discharge.

$$\text{Eq. (1)} \qquad \frac{\text{Total units } CrH_x}{(\text{in.}^2)\ \text{sec}} = (k_1)\ (CD)\ (CE)$$

One chromium atom in chromic acid is deposited by 1.6×10^{-19} coulomb for each of the six positive charges to be neutralized, or (6) (1.6×10^{-19}) amp-sec where k_1 is a constant and equals

$$\frac{\text{number } CrH_x \text{ units}}{\text{amp-sec}} = \frac{1}{(6)\ (1.6 \times 10^{-19})\ \text{amp-sec}} = 1.04 \times 10^{18}$$

and the k's in all the following equations are also proportionality constants. Before CrH_x has covered the entire bare surface, some CrH_x alloy will be deposited on the first CrH_x. The rate at which CrH_x will cover freshly deposited CrH_x is proportional to the fraction of the total surface covered by CrH_x. Thus if $\emptyset$ is the fraction covered at any instant, then

$$\text{Eq. (2)} \qquad \frac{\text{units } CrH_x \text{ covered}}{(\text{in.}^2)\ \text{sec}} = (k_1)\ (CD)\ (CE)\ \emptyset.$$

But $\emptyset$ is changing as deposition continues in proportion to the product of CD × CE × time (t) × fraction of total surface that is uncovered $(1 - \emptyset)$.

$$\text{Eq. (3)} \qquad \frac{d\emptyset}{dt} = (k_3)\ (CD)\ (CE)\ (t)\ (1 - \emptyset), \text{ or}$$

$$\text{Eq. (4)} \qquad \frac{d\emptyset}{(1 - \emptyset)} = (k_3)\ (CD)\ (CE)\ (tdt).$$

When the fraction of the surface covered by CrH_x is very small (say less than 0.1), then $\emptyset << 1$, and

$$\text{Eq. (5)} \qquad \emptyset = \left(\frac{k_3}{2}\right)(CD)\ (CE)\ (t^2)$$

Substituting Eq. (5) into Eq. (2), we see

$$\text{Eq. (6)} \qquad \frac{\text{units } CrH_x \text{ covered}}{(\text{in.}^2)\ \text{sec}} = \frac{dn}{dt} = (k_4)\ (CD)^2\ (CE)^2\ (t^2)$$

where n is the amount of CrH_x covered per square inch. Integrating Eq. (6), we have

$$\text{Eq. (7)} \qquad n = \frac{\text{units } CrH_x \text{ covered}}{\text{in.}^2} = k_5\ (CD)^2\ (CE)^2\ (t^3)$$

Eq. (7) symbolizes several practical points:

Note that n increases with the cube of the "on time." Thus, for any given CD and CE, a current pulse of twice the duration will have eight times the density of covered CrH_x alloy. Similarly a decrease of t by 10 per cent reduces n by 30 per cent (28.1 per cent).

Note that n increases in proportion to the square of the product of CD × CE. Since CE is well known to increase with increasing CD, this relationship means that the most CrH_x alloy will always be deposited on the high CD areas, and always by more than what CD alone would indicate.

Eq. (7) also shows that the higher the CD and CE, the shorter the "on time" should be.

The maximum "on time" for a desirable chromium plate directly on aluminum can be defined by Eq. (1): the product of $k_1 \times CD \times CE \times$ (on time) must be less than 100 per cent of the total amount of CrH_x required to cover one square inch of total surface. Less than 50 per cent coverage is preferred. CD is the maximum average CD at any point on the plated object during "on time," CE is that associated with the maximum average CD during "on time." About 1.2×10^{16} units of CrH_x cover one square inch. As an example, when the over-all average CD is 1.5 amp/in.^{2}, the maximum average CD during on time, at an edge of a flat panel may be 5.0 amp/in.^{2}. At this high CD edge, the CE may be 0.2, whereas in a low CD area the CE may be as low as 0.1. The maximum average CD during "on time" is limited by the high CD area as calculated with Eq. (1)

$$(5.0\ \text{amp/in.}^2)\ [0.2]\left[\frac{1\ \text{unit } CrH_x}{(6)\ (1.6 \times 10^{-19})\ \text{amp-sec}}\right](\text{time}) = (1.2)\ (10^{16})\ \frac{\text{units } CrH_x}{\text{in.}^2}.$$

Maximum "on time" = 11.5 milliseconds.

The above definitions of average CD's differ from the average CD observed with an ammeter. Conventional d-c voltmeters or ammeters indicate by the movement of a relatively heavy needle. These ammeters purposely are built to show a steady average reading even though the values of voltage or current may be fluctuating rapidly over wide limits. Thus, if current were flowing about 90 per cent of the time, the average CD during "on time" equals the average CD read on a meter divided by 0.9 or divided by 0.5 for 50 per cent. Thus, if current were flowing only 50 per cent of the time, the average CD during "on time," would be twice that of the average CD read on a meter. Thus, in the use of Eq. (1), as illustrated above, (meter average CD) × (pulse time) = (true average CD during on time) × (on time). Note that the change in "on time" is canceled by a

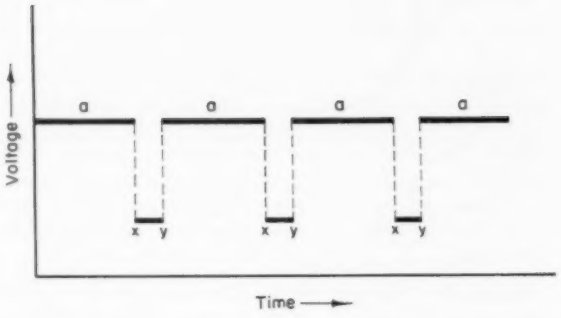


Fig. 3. Form of voltage curve for electrodeposition of and decomposition of CrH_x units in chromium plating.

TABLE I

CORROSION RESULTS OF ALUMINUM

(Special panels as shown in Fig. 4)

Plate System[a] (mil)	Five Per Cent Salt Spray			CASS		
	Hours	Rating	Appearance	Hours	Rating	Appearance
BUFFED 0.1 new Cr[b] Plated in laboratory (8-½ by 4 in. panels)	144	5	Pits had same appearance as after Corrodkote. More damage than in CASS and Corrodkote.	9	6	Many clean, fine pits like those on outdoor panels. No blisters. Nearest match to 1 year on Columbus roof.
TRIPLATE 0.2 0.1 new Cr[b] – 0.2 bright Ni – 0.02 Cr(HTHR) Plated in laboratory 8-½ by 4 in. panels)	168	8	Failure as 1/16 in. to ⅛ in. blisters at edge, and 1 or a few blisters in groove crease. Excellent on flat and curve. Nearest match to 1 year on Columbus roof.	9	6	Medium size blister pits in flat, < 1/64 in. Few in groove and on curved surface. Seldom an edge blister.
				—	—	
				18	5	Larger number of medium blisters. Numerous edge blisters.
TRIPLATE 0.6[c] 0.1 new Cr[b] – 0.6 bright Ni – 0.02 Cr(HTHR) Plated in laboratory (8-½ by 4 in. panels)	168	9	None to 3 edge blisters otherwise failure only at rack mark.	18	8[c]	About same as Corrodkote in sharp groove. Scattered small (<1/32 in.) blisters on flat and curved surface. Occasional edge blister.
BUFFED 0.1 new Cr[b] Plated in pilot plant Twelve 8-½ in. by 8 in. panels per load	72	6	No edge failure. Heavy population of small blisters at groove region. Few pits on flat and curved surface.	18	5	Heavy corrosion ½ in. to ¾ in. wide in groove region. Scattered fine blister pits on flat and curved regions.

(a) Number in column is plate minimum thickness in mils. Five panels for each system in each test. Kind of panel is shown in Fig. 4.
(b) DURAMIR by procedure in this paper.
(c) TRIPLATE with 0.8 mil minimum bright Ni rated 10 after 36 hours' CASS. All panels in this row would rate about 1 unit higher if narrow (1/16 in. to 1/8 in.) base of groove (see Fig. 4) is not included in the rating.

change in the value of CD, so that the product is the same. However, according to Eq. (7), the number of deposited CrH_x units varies more with the "on time" than with CD, so that quality of the final plate is best controlled with the proper definitions of CD, CE, and "on time" given above.

With a direct current with voltage pattern as shown in Fig. 3, the "on periods" for plating and the "off periods" for decomposition of CrH_x can provide a chromium plate that is crack-free, relatively soft, and sufficiently free from stresses for plating aluminum without edge flaking, cracking, or peeling. Note that according to the above calculations the "on time" is on the order of 11.5 milliseconds. The preferred "on time" is considered as 5 to 50 per cent of that needed to give theoretical coverage as defined by Equation (1). By providing "off time," the surface units of CrH_x can decompose, an event which cannot be completed while plating current is flowing. If the CrH_x does not decompose, it is covered during the next pulse. Such covered or occluded units add stress to the plate which will pull the plate away from aluminum, or if enough CrH_x units are covered over, the chromium plate itself will crack, because the CrH_x is unstable above 32F.

As maximum "on time" is defined above, the shape of curve yax in Fig. 3 is not important. The important point is that the duration of "on time," yax, should not exceed that necessary to lay down one complete monolayer of CrH_x units. An important conclusion from this hypothesized mechanism is that there must be an "off time," as represented by the flat region xy in the yax curve of Fig. 3, to obtain a satisfactory chromium plate.

TABLE I

PLATED WITH THE NEW CHROMIUM

Corrodkote			Outdoor Columbus			Outdoor Kure Beach		
Hours	Rating	Appearance	Months	Rating	Appearance	Months	Rating	Appearance
8	7	Occasional edge flakes 1/32 in. band. Scattered circular-pit clusters. 1/4 in. wide region of pits at groove region. No large blister pits.	12	5	Failure about same as 9 hour CASS. More fine edge flakes than CASS or Corrodkote. Finer pits than caused by Corrodkote.			No panels exposed.
16	7	Failure only in the groove region. Only few small blisters on flat and curve. Seldom an edge blister.	12	8	More edge blisters than caused by the accelerated tests. Fine (<0.1 in.) clean pits (no blisters) scattered in groove region.	12	5	Nearest match is 18-hour CASS exposure. Most unlike 168 hour five per cent salt spray and outdoor in Columbus. Curved surface generally better than the flat.
	9	Several small blisters in sharp groove. None to 2 edge blisters. Nearest match to 1 year on Columbus roof.	12	9	Several small blisters in sharp groove. None to 2 or 3 edge blisters.	14	8	These panels had 0.7-mil/ minimum bright nickel. Same appearance after 18 hours in CASS. Most attack was in base of groove where thinnest plate. More attack than 24 hours' Corrodkote, 168 hours' salt spray, or 1 year outdoors in Columbus.
8	6	Blisters in sharp bottom of the groove 3/16 in. diameter. Clusters of blisters random on flat and curved surfaces. 6 to 12 edge blisters.	12	5	Failure about the same as the 8-1/2 by 4 in. panels in the first horizontal line above.	14	2-1/2 to 3	More corroded than any panel in the other exposures.

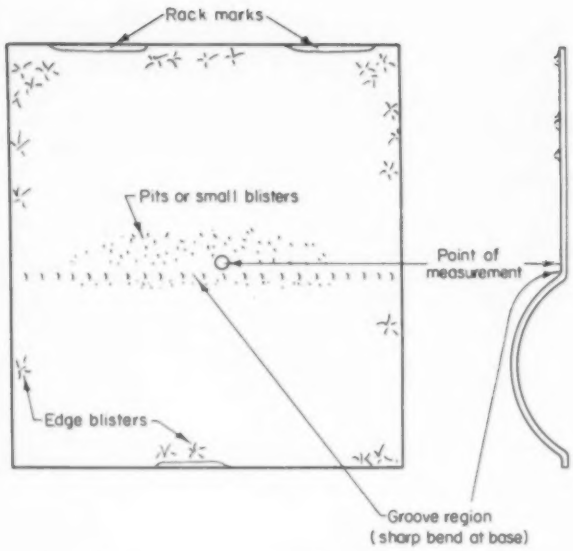
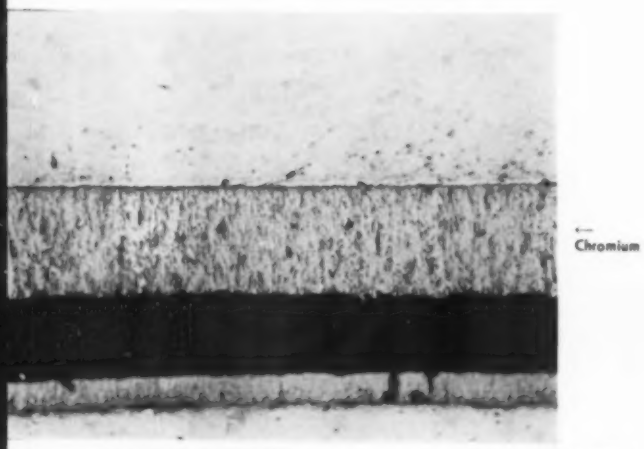


Fig. 4. Kind of aluminum panel used for plating and exposure tests tabulated in Table I, and corrosion pattern.

As noted at the beginning of this discussion, two reactions are hypothesized to occur during "off time." Reaction 3 is the decomposition of CrH_x. Reaction 4 is the change in *p*H at the cathode-solution interface. The minimum "off time" is that necessary to allow the substantial completion of Reaction 3 before a new unit layer of CrH_x is deposited. The maximum "off time" is that allowing completion of Reaction 4. The rates of both reactions increase with increase in bath temperature. However, the ratio of the rates is approximately temperature independent.

Therefore, the absolute values of maximum and minimum "off times" change with temperature, but the ratio of maximum to minimum does not change. The rate of Reaction 3 is about 5 times as fast as the rate of Reaction 4 by experimental observation of plating results. When the temperature is about 150 F, Reaction 3 requires a minimum time of about 0.5 millisecond in a bath containing about 20 oz/gal chromic acid. With minimum "off time" of about 0.5 millisecond, maximum "off time" is about 2.5 milliseconds.

The rate of Reaction 3 is practically independent of CrO_3 concentration, whereas the rate of Reaction 4 increases roughly in proportion to the CrO_3 concentration. Thus, in the above-mentioned example, minimum "off time" remains at about 0.5 millisecond when CrO_3 is doubled, and control of "off time" is more critical than control of CrO_3 concentration.



Original Magnification 500X N 47526

Fig. 5. Structure of chromium electrodeposited by the process described in this paper. (Electrolytic etch in ten per cent oxalic acid solution.)

PLATING PROCEDURE

Special test panels 8-¼ by 4 in. or 8-½ by 8 in. as shown in Fig. 4 were used. Shaped parts as shown in Fig. 2 have been plated in 5000-ampere loads.

A pair of preparation dips have been devised, using solutions that are chemically compatible with each other and with the chromium plating bath. None of the baths is contaminated by drag-in of the others. Then, after rinsing and while still wet, the aluminum was plated as follows:

Bath composition:

Chromic acid	27 oz/gal
Sulfate	0.18 oz/gal
Additive	0.2 oz/gal
Current density	1 to 1.5 amp/sq in.
Temperature	140 F
Time	20 to 30 minutes/0.15 mil, depending on shape
Voltage	5.8 volts at 4700-ampere loads.

Anodes are lead-tin alloy, because lead-antimony anodes introduce antimony into the bath and antimony is detrimental to the quality of the plate. The chromium plate had a hardness of 332 to 389 Knoop.* For comparison, the hardness of chromium deposited with direct current from a motor-generator set was 655 to 728 Knoop. The cathode efficiency was about 14.1 per cent with this new direct current compared with about 16.1 per cent for plating with direct current from motor-generator and from conventional rectifiers.

This new chromium plate has a columnar structure as shown in Fig. 5, and parts plated with it could be band sawed without flaking or spalling, nor did the plate spall off when plated aluminum was bent severely. However, such bending cracked the as-plated chromium. After heating a chromium-plated part to red heat, the chromium plate did not crack on bending.

For applying the chromium-nickel-chromium plate systems of Table I, the aluminum was first chromium plated as mentioned in the preceding discussion. After rinsing, the chromium-plated aluminum received a nickel strike plate by the Wood procedure,[6] was rinsed, and bright-nickel plated. Several of the commercial bright-nickel-plating procedures were found satisfactory. Duplex nickel has also been successfully applied over the nickel strike. Excellent brightness and color is provided by 0.15-mil chromium – 0.8 to 1.0-mil bright or duplex nickel – 0.035 to 0.050-mil chromium. When the new chromium is deposited over bright nickel, the bath temperature is 115 F.

The Wood strike-plating bath is somewhat too active chemically for aluminum parts with deep recesses where no chromium is deposited. A less active strike is under study

* 100-gram load.

TABLE II

CORROSION RESULTS WHEN THE NEW CHROMIUM PLATE IS USED OVER NICKEL PLATE[a]

Plate and Thickness				Rating After Accelerated Corrosion[b]									
Chromium		Nickel		Number 20-Hr Cycles Corrodkote					Hours CASS				
Type	Mil	Type	Mil	1	2	4	6	8	18	36	72	108	144
Process of this paper[c]	0.055	Duplex	0.8	10.0	10.0	10.0	9.9	9.2	10.0	10.0	10.0	10.0	9.5
	0.025	Duplex	0.8	10.0	10.0	10.0	9.5	7.9	10.0	10.0	9.6	9.6	8.9
	0.055	Bright	0.8	10.0	10.0	10.0	9.3	8.2	10.0	10.0	9.6	8.6	7.7
	0.025	Bright	0.6	10.0	9.9	9.1	7.9	6.5	9.8	7.4	6.2	Not continued	
Duplex	0.055	Duplex	0.8	10.0	10.0	9.8	9.4	8.9	10.0	9.8	8.5	8.0	7.1
	0.025	Duplex	0.8	10.0	10.0	9.3	7.8	7.1	10.0	9.8	9.4	8.8	8.0
	0.055	Bright	0.8	10.0	10.0	9.4	8.7	7.5	10.0	8.9	7.4	6.3	—
	0.150	Bright	0.8	10.0	10.0	9.9	9.7	9.3	10.0	10.0	8.6	8.4	8.4
HTHR	0.055	Duplex	0.8	10.0	10.0	10.0	9.9	9.3	10.0	10.0	9.8	9.4	8.7
	0.055	Duplex	1.2	10.0	10.0	10.0	9.9	9.1	10.0	10.0	9.9	9.4	9.1
	0.025	Duplex	0.8	10.0	10.0	10.0	9.4	8.2	10.0	9.9	9.8	8.9	7.9
	0.055	Bright	0.8	10.0	9.6	9.5	Not tested		10.0	9.7		Not tested	
	0.055	Duplex	0.4	10.0	10.0	9.7	8.9	7.5	10.0	9.8	8.9	8.1	7.5
LTLR	0.01	Duplex	0.8	10.0	9.7	8.2	7.1	6.3	10.0	10.0	9.5	8.6	7.2
	0.01	Bright	0.8	7.8	5.2		Not continued		6.0	4.7		Not continued	

(a) All panels were zinc die castings with 0.4-mil copper, then nickel, and the new chromium. The duplex nickel had first-layer columnar leveling, semibright as 70 per cent of total nickel — 30 per cent bright, except the 0.4-mil duplex nickel which asw 55-45. HTHR chromium was plated from 45 oz bath 150 ± 5/1 sulfate ratio; 300 amp/sq ft; 130 F. LTLR chromium was plated from 33 oz bath 95/1 sulfate ratio; 150 amp/sq ft; 110 F.
(b) Weighted-area rating system, ASTM Proceedings, **53**, pp 267-269.
(c) DURAMIR.

and in preliminary tests was quite satisfactory prior to bright-nickel or duplex-nickel plating.

CORROSION PERFORMANCE OF DIRECT-CHROMIUM-PLATED ALUMINUM

Chromium-plated aluminum matches the appearance of any other basis material on which chromium is the final plate. For approaching color match by bright anodizing, special alloys or high-purity aluminum must be used. The process described herein can be used for chromium plating anodizing-type aluminum alloys as well as 3003, certain extrusion alloys, and certain aluminum die castings. Of the alloys to be used in press-forming operations, the 3003 may be preferred when the finish is to be chromium plate.

Prospects for chromium plating aluminum items for color match with other chromium-plated items, requires knowledge of corrosion performance. The research that supplied the information for this paper was begun shortly before CASS[7] and Corrodkote[8] tests were adopted as accelerated tests for evaluating corrosion performance of copper-nickel-chromium (or nickel-chromium) plated zinc die castings and steel parts. These corrosive media contain copper salts (and in Corrodkote, also a ferric salt) because of accelerated effect on the corrosion couples: copper-nickel, nickel-chromium, and nickel-nickel (in duplex nickel).

To our knowledge, no data have been published on chromium-plated aluminum exposed in CASS or Corrodkote. Therefore, the information in Table I will be of interest. Five different environments are covered: five per cent salt spray; CASS; Corrodkote: one year outdoors in Columbus, Ohio; and one year outdoors at Kure Beach, North Carolina.

All three accelerated tests showed that breakdown started in the same places on the panel as in the two outdoor exposures. The general pattern of failure was the same in all five situations. Interpretation of the data in Table I indicates that CASS is more severe than Corrodkote on chromium-plated aluminum. The accelerated exposure that matched outdoor exposure in type of failure depended on the plate system.

An important conclusion is made that exposure periods specified for plated zinc die castings and for plated steel parts in CASS and Corrodkote are not reliable for predicting outdoor performance of chromium-plated aluminum.

BRIGHT CHROMIUM ON BRIGHT-NICKEL PLATE

Plating with current corresponding to the special wave form described for voltage in this paper, provided good throwing power and clear, bright, crack-free chromium at thicknesses of 0.1 mil or more over bright-nickel plate. In keeping with other researches on the advantages of thick crack-free chromium plate, the corrosion-test data in Table II will be of interest. The panels are zinc die castings which were plated for inclusion in the program of the American Zinc

Institute.* The data for duplex, HTHR,** and LTLR*** chromium also are reported here for ease of reference.

The reader will note that on panels listed in Table I, the final chromium is HTHR. These panels were plated early in the research program while efforts were directed toward plating on aluminum. The good showing by the new chromium plate over bright nickel according to Table II indicates that triplates such as those in Table I should be made using the new chromium as the final plate. Such plates have been made and confirm the expected good results in CASS. For example, press-formed 3003 aluminum parts with 0.15-mil chromium – 0.8 duplex nickel**** – 0.040-mil chromium***** were rated 10 after 36 hours' CASS exposure. Results to be described in a later paper show other advantages for chromium plating by the special current over bright nickel.

ACKNOWLEDGMENT

The assistance of various members of the Battelle Memorial Institute staff is gratefully acknowledged: W. H. Safranek and John G. Beach for some of the plating and corrosion tests and interpretations, and John McCallum for the mechanism analysis and calculations. Appreciation is due to R. L. Deubner, manager, Chrome Plating Division, and William D. MacLean, coinventor, General Development Corporation for active interest and practical guidance.

The research reported herein was sponsored by the General Development Corporation whose permission to publish is acknowledged.

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* Published herein by permission of American Zinc Institute. See also paper by Safranek, Miller, Hardy, and Faust Proc. American Electroplaters' Society **60,** 96 (1960) and References[6-8].

** 45-oz bath; 150 ± 5/1 sulfate ratio; 130 F; 300 amp/sq ft.

*** 33-oz bath; 91/1 sulfate ratio; 105 F; 150 amp/sq ft.

**** 70 per cent columnar, semibright, leveling plate-30 per cent bright plate by thickness.

***** Both chromium plates applied by the new process.

Dr. Charles L. Faust was a graduate assistant at the University of Minnesota, receiving his PhD in Chemical Engineering in 1934. For a brief period, he was with the Southwestern Bell Telephone Company and Western Electric Company. He joined the staff of Battelle Memorial Institute as a Research Engineer in 1934, and has been Chief of the Electrochemical Engineering Division for the past 15 years. Metal finishing, electroplating, electro-winning, electrorefining, and extractive electrometallurgy, electrolysis and batteries, electroprocesses, and waste disposal are the subject of the division's activities. He is author or coauthor of over seventy technical articles, chapters in eight books, and over 40 patents.

He is a member of The American Chemical Society, The Electrochemical Society, The American Electroplaters' Society, The Institute of Metal Finishing, and is a charter member of the Columbus Branch, AES, for which he has served on the board of managers and as a Delegate. He was corecipient of The Proctor Award in 1940, of AES gold medals in 1951 and 1955, and of the Carl Heussner award in 1955.

He was an associate editor of the Monthly Review and of PLATING, publications of the American Electroplaters' Society from 1942 until 1949; associate editor of Modern Electroplating, second edition, 1953; associate editor of Electroplating Engineering Handbook, 1955. At the present time, he is Section Editor of Chemical Abstracts, Section 4, Electrochemistry.

Dr. Faust was a member of the board of directors of The Electrochemical Society from 1943 to 1945 and 1947 to 1951. He was a vice president from 1947 through 1949 and was president of the Society in 1950.

During the war, he served on a subcommittee of the War Metallurgy Committee and was associated with special research and development for the war effort. Now he is a consultant for the Materials Advisory Board of the National Academy of Science. He is a registered Professional Chemical Engineer of the State of Ohio.

Glenn R. Schaer received his BS degree in chemical engineering from The Ohio State University in 1954. He has been at Battelle 16 years and is now senior chemical engineer. He has been closely associated with developments in electropolishing, chromium plating, plating on molybdenum, and properties of electroplates at high temperatures. Mr. Schaer is recipient of the AES bronze medal in 1957, and is a member of the Columbus Branch, AES, and of The Electrochemical Society. He has coauthored three papers and is named on eight patents on electroplating, and is a registered professional chemical engineer of the State of Ohio.

Donald E. Semones received his BS degree in chemistry at The Ohio State University in 1953. He became a Battelle staff member at that time and has been engaged in research on metal finishing, electroplating, and batteries. Mr. Semones is a member of the Columbus Branch, AES, and The Electrochemical Society. This is his first appearance as an author.

THE PRESENT STATUS OF DECORATIVE NICKEL-CHROMIUM COATINGS:

A Survey

by WILLIAM BLUM*

I. SUMMARY

A SURVEY AND ANALYSIS were made of the published papers and other available information on the behavior of decorative nickel-chromium coatings. The results may be summarized in the following conclusions, which are based on coatings on steel or zinc die castings, with a final layer of chromium. These are listed in the approximate order in which they appear in the text, and not in the order of importance.

1. CASS and Corrodkote tests yield good but not perfect correlation with exposure tests and service performance.

2. Sulfur dioxide tests serve principally to evaluate the continuity of the chromium layer, as they rapidly attack exposed nickel, but corrode copper very slowly.

3. Static exposure tests in an industrial atmosphere are usually less severe than service performance.

4. In accelerated and static exposure tests a composite coating of copper plus Watts nickel on steel usually furnishes less protection than does an all-nickel coating with the same total thickness. In certain exposure and service tests with some bright nickels, copper was beneficial.

5. Deposition of nickel on zinc-base die-castings with no initial copper layer is promising but not yet practical.

6. Organic types of bright nickel that contain sulfur do not usually furnish as good protection as does buffed Watts nickel.

7. Failure of bright nickel may be fostered by: (a) its lower purity, (b) its brittleness, (c) its fine grain, (d) its stress, and (e) its laminated structure. These characteristics change during extended use of the baths.

8. Sulfur-free semi-bright nickel is less susceptible to attack than is bright nickel.

9. Duplex nickel coatings consisting of semi-bright plus bright nickel furnish better protection on both steel and die-castings than do coatings with the same total thickness of bright nickel; and about the same protection as does Watts nickel.

10. Increasing the thickness of regular chromium above the customary 0.01 mil improves the protection but increases the tendency for crazing.

11. Microcracked chromium yields improved performance in CASS tests, but usually with some loss of luster.

12. Crack-free chromium with a thickness of at least 0.03 mil usually yields better protection than does regular chromium as thick as 0.05 mil.

13. Duplex chromium coatings with a total thickness of 0.03 mil of regular or crack-free plus microcracked chromium give improved performance in accelerated tests, but usually with some loss of luster.

14. Sandwich chromium coatings, with a layer of chromium between two bright nickel coatings on steel, or between copper and nickel on zinc, yield favorable results in static exposure tests.

15. Many of the above combinations are beneficial because they retard penetration of corrosion to the basis metal by fostering lateral corrosion of one or more layers.

16. An important factor is the relation of the potentials of the metal layers and the direction and magnitude of the resultant currents.

II. INTRODUCTION

Many persons in the plating industry and also the general public believe that the quality of decorative plating, especially on automobiles, was not as good a few years ago as it was formerly. All agree, however, that there has been a substantial improvement in quality during the last two years. Numerous researches have been conducted or are in progress to determine the causes of failure of certain coatings and to insure satisfactory performance. This report summarizes the results of a survey of recently published papers, in which the available data have been evaluated. No final judgments can be reached until more extensive researches and service tests have been completed. No reference is made to costs, which will depend upon the scale of operation and the existing equipment and available space.

*Consultant, Washington, D. C. Formerly Chief, Electrodeposition Section, National Bureau of Standards.

The discussion is devoted principally to coatings consisting of copper, nickel and chromium, applied to steel or to zinc-base die-castings. Unless otherwise stated, all deposits had a final layer of chromium. The experience and needs of the automobile industry have been emphasized, but similar factors are involved in the plating of other articles for severe service, such as bicycles. Details of the methods employed in the researches will be found in the publications cited by numbers in superscript that correspond to those in the bibliography.

III. BACKGROUND

The plating on steel parts of early automobiles usually consisted of copper plus nickel with a total average thickness of less than one mil. Such coatings furnished little protection against the corrosion of the steel, and the nickel surface tarnished. These defects were not conspicuous because the body finishes were equally poor. With the development of improved body finishes in the early 1920's, a demand arose for better plated finishes. The advent of chromium plating, first applied to automobiles about 1927, brought about an immediate improvement in the appearance and performance of the plated coatings.

More exact knowledge was required before the most favorable composition, thickness and other properties of the plated coatings could be defined and specified. This demand led to the studies and exposure tests conducted from 1930 to 1940 at the National Bureau of Standards (NBS) with the cooperation of the American Society for Testing Materials (ASTM) and the American Electroplaters' Society (AES), which were continued by ASTM Committee B-8. Specifications for plated coatings were formulated, and were revised from time to time.

In World War II, decorative plating and the production of private automobiles were practically discontinued. When plating was resumed in 1946, there was a definite increase in the thickness of the nickel layers, followed by the regular thin chromium deposits. While considerable progress had been made prior to 1941 on the development of bright nickel plating, this was not extensively applied to automobiles, especially on bumper bars, until about 1947. From 1950 through 1957 the stockpiling of nickel by the government reduced the supply of nickel available to industry; and any failures of the plated coatings were then usually ascribed to the use of too little nickel. However, when adequate supplies of nickel were again available in 1958, the performance of the plated coatings was still not entirely satisfactory. This situation pointed strongly to the conclusion that the bright nickel coatings then used did not generally furnish as good protection as did the buffed dull nickel of equal thickness that was applied in earlier years.

Formerly it was generally assumed that failure of a nickel-chromium coating was principally the result of pores initially present in the nickel. More recent studies show that while corrosion can occur through penetration of initial pores, there is a strong possibility of attack of the nickel coating through pores or cracks in the relatively thin chromium layer.

IV. METHODS OF TEST

1. Preparation of specimens

One of the obstacles to research on methods of test and on new types of coating is the difficulty of producing uniform specimens. Many exposure studies have shown that it is difficult to prepare specimens so uniformly that, in a set of five or more panels in a given location, the ratings are nearly the same. Specimens prepared under controlled laboratory conditions are generally more uniform than those produced in a plant, even in an automatic conveyor.[43]

2. Accelerated tests

A serious obstacle to progress in this field is the difficulty of devising rapid or "accelerated" tests from which the actual, or at least relative, service performance of coatings can be predicted. Obviously, the conditions of the test must be more severe in some respects than those likely to be encountered in service. Otherwise the test would require almost as long a time, for example, one or two years, as the coatings are expected to give good service under severe conditions.

The most obvious methods of accelerating a chemical reaction such as corrosion are the use of (a) higher concentrations of those compounds likely to be encountered in service; (b) more corrosive reagents; (c) more corrosive conditions such as agitation of the surrounding media, or the presence of fogs that present a very large surface of the corrosive agent, with possibly higher concentrations of dissolved oxygen; (d) continuous or systematically alternated conditions; and (e) higher temperatures.

The following accelerated tests were employed in one or more of the researches under consideration.

A. Spray tests

(1) Neutral salt spray (SS)

In the original salt spray test announced in 1914 by J. A. Capp,[1] and subsequently more closely defined, a neutral solution of sodium chloride was sprayed to produce a fine fog, at an elevated temperature such as 35C (95F). The rate of settling of the liquid upon a definite area was specified, but not maintained within close limits. After this test had been widely used for about 25 years, controlled comparisons showed that it did not yield reproducible or significant results on plated coatings. At best it serves only to distinguish very good from very poor coatings of a given type. Hence the use of this original salt spray test has been practically discontinued.

(2) Acetic acid salt spray (ACSS)

The neutral salt spray test was modified[7] by the addition of about 1 per cent of acetic acid (sufficient to produce a *p*H of 3.0) to a five per cent solution of sodium chloride. With this change and with closer control of all conditions, the types of failure, especially of nickel-chromium coatings on zinc die-castings, more nearly resembled those encountered in service.

(3) Copper chloride modified acetic acid salt spray (CASS)

More recently[34, 54] in connection with studies of AES Project 15, small amounts of cupric chloride have been added to the acidified salt solution. With this modification, results that simulate failures in service are obtained in a shorter time than in the ACSS test.

B. Gaseous tests

(1) Sulfur dioxide test (SO_2)

Because sulfur dioxide is a constituent of industrial atmospheres, accelerated tests have been developed in which sulfur

dioxide is the principal corrodant. The simplest of these is the "sulfur dioxide accelerated corrosion test," devised in England by J. Edwards.[16, 33] In each cycle the specimens are exposed to air containing one per cent of sulfur dioxide, with a relative humidity of 95+ per cent, at 25C (77F) for 24 hours.

(2) Sulfur dioxide plus carbon dioxide (K)

In the Kesternich test,[11] developed in Germany by W. Kesternich, the plated articles are exposed for 8 hours in an apparatus having a total volume of 300 liters. Into it are introduced 2 liters of water, 2 liters of sulfur dioxide, and 2 liters of carbon dioxide. The liquid is heated to 50C (122F), and water condenses on the specimens. After eight hours, the apparatus is opened and the specimens are allowed to stand in the open box for 16 hours. A test may consist of as many as six of these 24-hour cycles.

C. Slurry tests

(1) Corrodkote (CK)

AES Project 15 was established to develop an accelerated corrosion test that will simulate the most corrosive conditions encountered in an urban industrial location, for example, winter driving in Detroit. The committee first analyzed the air and the snow and slush found on the streets. They also exposed panels of steel and zinc die-castings, plated with coatings having a graduated thickness, to service on taxicabs in the Detroit area, and recorded the types and extent of corrosion or other failures.

On the basis of these observations, Project 15 Committee developed the "Corrodkote" test,[32] which is now being thoroughly studied in several laboratories. In this test the plated surfaces are coated by means of a brush with a slurry of clay (kaolin) mixed with an aqueous solution containing cupric nitrate, ferric chloride and ammonium chloride. The coating is allowed to dry in air for one hour. The specimens are then placed in a humidity cabinet at 38C (100F) and 90 to 100 per cent relative humidity, without condensation. After 20 hours the specimens are removed, washed and inspected for evidences of corrosion or other defects. Plated steel specimens may be subsequently exposed to a humidity of 100 per cent with condensation, to reveal any rust spots.

3. Static exposure tests

Starting in 1932 in the joint researches of the AES, ASTM and NBS, specimens plated with coatings of prescribed composition, thickness and method of application were exposed to the atmosphere in locations representing industrial, marine and rural climates. These tests were continued and extended by ASTM Committee B-8, and similar tests have been conducted by several research groups.

The results show that the frequent assumption that continuous atmospheric exposure represents actual service conditions is not entirely valid. On automobiles the plated parts are occasionally washed and treated with a wax finish. Efforts to introduce such steps in exposure tests are cumbersome, and may yield misleading results. In exposure tests in a given location the climatic conditions vary during the year, and are also different from year to year. The conditions prevailing during the first few weeks of a test may greatly affect the rate and extent of subsequent corrosion. Hence the results of static exposure tests are of value for estimating the relative and not the absolute degrees of protection.

4. Service tests

For many years automobile manufacturers have made systematic observations on the appearance of plated parts on cars of their own and competitors' makes. Results have also been obtained from a limited number of cars with plated parts finished under specific conditions, and operated by individuals who keep records of service and care. These conditions were closely approached in tests conducted by AES Project 15 with panels mounted on taxicabs. Similar "mobile" exposure tests have been conducted by certain firms. Udylite[28] and Chrysler[32] reported tests in which plated car parts or panels were (1) mounted on cars operated in normal service, (2) exposed in roof tests, and (3) subjected to accelerated tests.

5. Methods of rating

In any systematic studies on the performance of plated coatings, it is not sufficient to describe or even to photograph the evidences of failure; or to merely state, e.g., that set A is better than set B and worse than C; or to use qualitative terms such as excellent, good, fair and poor, to describe the performance of the coatings. Certainly the recording of the types of failure is important, as it may assist in the formulation of the causes, mechanism and remedies for the deterioration. However, some numerical system is essential to compare results for different sets and observers, and to compute averages and relative performances.

In the first AES, ASTM, NBS exposure tests,[5] a scale from 5 to 0 was employed, in which a rating of 5 represented a nearly perfect surface, and one of zero a coating of which 50 per cent or more of the area showed defects. Because the first small extent of surface failure, for example two per cent, is much more significant than a difference of two per cent between, for example, 30 and 32 per cent, the scale was made roughly logarithmic. This same principle was retained when ASTM Committee B-8 expanded the scale to include ratings from 10 to 0. There has been no serious criticism of this scale as a basis for rating.

There have, however, been many discussions in B-8 meetings regarding the use of the scale to evaluate specific types of failure. The principal problem is whether the rating, R, should be based on (a) the protective value as judged by the evidence of visible basis metal corrosion products, or (b) on the overall appearance of the surface, including cracks, crazing, blisters, craters, surface pits, and peeling. Obviously the "appearance" rating will also include evidence of basis metal corrosion; hence it can never be higher than the "protection" rating, and may be lower. Efforts to base the final rating on a composite of the two ratings, to which different weights may be assigned, have not been entirely acceptable.

Unlike zinc coatings that are applied primarily to prevent structural corrosion of the steel, nickel-chromium coatings are applied principally to attain and maintain a pleasing appearance. Any rust on plated steel, or white corrosion products on plated zinc, are certainly conspicuous and unsightly. But blisters and craters also damage the appearance and are not so easily removed as are rust and stains. Pitting, cracking and mere dulling of the surface are undesirable, but not always conspicuous or objectionable.

In this survey it has not always been possible to determine what basis was used by each author for the ratings reported by him. Unless otherwise indicated, the values of R quoted in this report are assumed to be "appearance" ratings.

Recently an extension of the rating system was proposed by Battelle,[50] based principally on coatings on zinc die-castings. The authors define the "endurance limit" of a coating as the period in any specified test required to yield a rating of 9. The "endurance index" is defined as the ratio of the endurance limit of a particular system to that of a specified system, which in their illustration was system A, i.e., 0.4 mil Cu, 0.4 mil bright Ni, and 0.01 mil regular Cr, Cr, R. If for a given system the endurance index is 2, this implies that this system is twice as good as A.

Necessarily such a plan involves the arbitrary selection of a point of failure, in their illustration when R = 9, and of a standard of comparison, in this case system A. Since a rating of 9 represents the first definite evidence of failure, it may be less significant than, for example, a rating of 8. In a later report,[58] Battelle stated that they found good agreement of the endurance indices based respectively on ratings of 9 and of 8. It still remains to be determined whether different investigators can reproduce closely a given system such as A.

V. CORRELATION

1. Basis

One criterion of the value of an accelerated test is its ability to predict at least the relative performance of different coatings in static exposure tests or in service. The simplest way to check the degree of correlation of two or more tests is to arrange for each test the various sets in their order of merit, assigning the number 1 to the best coating. Mere inspection of the corresponding "rank" tables may indicate qualitatively whether the results in one test have approximately predicted those obtained in the other. However, a personal equation may enter, e.g., in the weight to be given to certain differences between the two sets of rank numbers. To make such a comparison entirely objective and to enable different workers to apply the same criteria, it is convenient to compute the "correlation coefficient" by accepted statistical methods. In this survey Spearman's equation was employed to compute certain correlation coefficients. Its application is explained in the Supplement.

2. Correlation of accelerated and exposure tests

The following coefficients were computed from data in published reports. Perfect correlation yields a coefficient of 1.0.

From the Battelle report to the American Zinc Institute[40] on coatings on zinc die-castings, 18 sets yielded the following values:

CORRELATION COEFFICIENTS

Accelerated Tests	Exposure Tests		
	Detroit	Kure Beach	Columbus
ACSS	0.82	0.89	0.85
CASS	0.87	0.92	0.82
Corrodkote	0.87	0.85	0.81

The exact values of the above coefficients are not significant, as they involve certain arbitrary decisions. Should the ratings for the accelerated tests be based on one or two cycles? On what period in the exposure tests should the comparisons be based? In the above computations the two-cycle values for the accelerated tests were employed. As the published data did not include long exposures for all the sets, the one-year values were employed (actually 12 months for some sets and 10 months for others).

In their most recent report to the American Zinc Institute,[56] Battelle employed a more involved statistical formula and obtained somewhat higher correlation coefficients between ratings in exposure and accelerated tests.

In the Chrysler report,[32] which included Corrodkote, Detroit roof exposure, and service on cars, the Corrodkote showed a correlation with service of 0.81; but with Detroit roof exposure of only 0.67. This difference was noted in their report. On 15 sets of steel panels plated by Harshaw,[28] Corrodkote yielded a correlation of 0.95 with exposure in Cleveland.

In a recent report from the General Motors Corporation (GMC),[54] steps taken to improve the performance and reliability of the CASS test were described. They found fair correlation of the CASS test with service performance of car parts, but suggested that their present CASS test specification requirements might well be made more rigid.

The above results show that most of the accelerated tests yield correlations above 0.80. Obviously it would be desirable to define and refine accelerated tests that would show at least 0.90 correlation with service. However, the results of static exposure and service tests are not always consistent.

3. Sulfur dioxide tests

The available data on the sulfur dioxide test[16, 33] and on the Kesternich test[11] do not permit computation of their correlation with exposure and service. The authors showed surface photographs and cross sections as evidence that these tests reproduce closely the types and extent of failure found on exposure, especially in industrial locations, where relatively high concentrations of sulfur dioxide may exist. It is difficult to predict what effect the carbon dioxide used in the Kesternich test has upon the form or rate of corrosion.

In any comparison of the sulfur dioxide test with other accelerated tests, it is pertinent to consider the rate at which nickel is attacked in various environments. The following values were reported by the International Nickel Co. (Inco):[31]

Environment	Nickel Type	Rate of Attack Mil/Year
New York, industrial	Rolled	0.15
Kure Beach, marine	Rolled	0.01
State College, rural	Rolled	0.01
Salt spray, 3% neutral	Rolled	0.27
Salt spray, 20% neutral	Rolled	0.05
CASS test	Rolled	2.8
Corrodkote	Rolled	7.4
Sulfur dioxide test	Rolled	330
Sulfur dioxide test	Electrodeposited	280

These data show that nickel is corroded most rapidly in industrial locations, and scarcely at all in marine or rural sites. The rate of attack in the CASS test is about 20 times that in New York, and in the Corrodkote about 50 times that in New York. In the sulfur dioxide test the nickel is dissolved about 2000 times as rapidly as it is in New York. In recent years the trend is to discount the effects of initial porosity of the nickel layer, and to emphasize the penetration of the

coating by ultimate corrosion of the nickel. The latter in turn depends upon the initial or subsequent porosity of the chromium layer. The sulfur dioxide test appears to be essentially a measure of the continuity of the external layer of chromium, a property that is assuming increasing importance with the advent of thicker and duplex chromium coatings.

Humber, Ltd.[25] reported that the sulfur dioxide test serves for rapid assessment of coatings on steel, but the ACSS is most useful for plated die-castings, and is "the most universally useful test of plated coatings."

In a recent paper from the Inco-Mond Laboratory in England,[60] it was concluded that "The SO_2 test is insensitive to the different activities of the two types of nickel and is not suitable for testing double-layer nickel coatings."

VI. VARIABLES IN THE PLATING SCHEDULES

Research and testing have been applied to plated coatings on steel and zinc with the following variables:

(1) Copper; none, thin or thick.
(2) Nickel; Watts, bright, semi-bright, and duplex.
(3) Chromium; regular, microcracked, crackfree, duplex and sandwich.

It is difficult to find many comparable experiments from which correlations can be computed. If the conclusions of different investigators are consistent, their validity is supported. If inconsistencies or contradictions are found, efforts should be made to explain the discrepancies and to suggest further research.

The following abbreviations are employed to designate baths and deposits. All thicknesses are expressed in mils (1 mil = 0.001 inch, or 25 microns).

Cu, Cn	Copper, cyanide
Cu, A	Copper, acid
Ni, W	Nickel, Watts, buffed
Ni, Br	Nickel, bright. The compositions were not disclosed.
Ni, SB	Nickel, semibright, usually sulfur-free.
Ni, Du	Nickel, duplex, consisting of a layer of Ni, SB followed by a layer of Ni, Br.
Cr, R	Regular chromium, from conventional or proprietary baths.
Cr, Mc	Microcracked chromium, with a system of very fine cracks.
Cr, CF	Crackfree chromium from conventional or proprietary baths.
Cr, Du	Duplex chromium, consisting of a layer of Cr, R or Cr, CF, followed by a layer of Cr, Mc.
Cr, Sa	Sandwich chromium, in which a layer of chromium is interposed between two nickel layers or between a copper and a nickel layer.

VII. EFFECTS OF A COPPER LAYER

From simple electrochemical principles, the more noble potential of copper relative to iron or zinc in most environments indicates that copper may accelerate the corrosion of adjacent exposed iron or zinc. The practical question is: "To what extent does this property of copper affect the behavior of composite coatings that contain a layer of copper?" Two questions may be confused: (a) With a given thickness of nickel, does an initial layer of copper reduce the protective value, and (b) with a given total thickness of coating does the substitution of copper for part of the nickel reduce the protective value? Because there may be incentives to substitute as much copper for nickel as possible, the latter question is most often raised.

1. **On steel.** In early years steel was almost always plated with copper prior to nickel, because (a) the cyanide copper bath exerts a cleaning action, (b) it has better throwing power, (c) copper can be readily buffed to a high finish, which reduces the amount of polishing of the steel, and (d) copper metal is cheaper than nickel.

In the early exposure tests,[5, 6] it was found that in coatings with a total thickness of 0.5 mil or less, a copper layer was detrimental in all locations. Copper was found to be harmful in thicker coatings in marine locations; but in certain industrial sites it was beneficial. In rural or suburban locations, copper had no detectable effect in coatings over one mil thick.

The possible effects of a copper layer became more important when bright nickel came into use, as the ease of buffing copper fostered the application of bright nickel on steel that had not been so highly polished. Whenever the supply of nickel was restricted during national emergencies, e.g., from 1950 to 1957, there was an incentive to substitute as much copper for nickel as possible.

According to reports recently received, most of the automobile companies in Europe permit or require a substantial layer of copper on steel before the nickel is applied. They justify this practice on the factors above mentioned, and also on the occasional use of steel with an inferior finish, and on a reported demand in Europe for a brighter and more nearly perfect finish on cars than is acceptable on many cars made in the United States.

Many authors in the United States believe that a coating containing a layer of copper generally yields less protection than is furnished by an all-nickel coating with the same total thickness. This conclusion was supported in a report from Inco,[10] based on normal exposures at Bayonne, N. J.; salt-accelerated exposures at Bayonne; neutral salt spray tests; and hot water tests. They attribute the detrimental effect of copper in part to the fact that corrosion products of any initially exposed copper accelerate attack of the adjacent nickel or chromium layers.

In the discussion of this paper[10] by W. M. Phillips of GMC, he reported that in an inspection of an average of 20 plated parts on each of 6000 automobiles that had been in service for one or two years, no difference was found between the parts having a copper layer and those without it. This observation again demonstrates that static exposure tests do not necessarily reproduce conditions of actual service.

The January 1960 report[45] of ASTM Committee B-8, Section A-II, Performance Tests, includes results of exposure tests of plated steel panels of Program 4 in Detroit and Kure Beach. Certain contradictory results were obtained on the effects of a copper layer. In Detroit the copper was detrimental on sets prepared by both Platers, X and Y. At Kure Beach the panels with copper that were prepared by Plater X were about equal to those without copper. On the contrary, those prepared by Plater Y that contained copper were superior to the all-nickel coatings. The Committee was unable to find any reason for this serious discrepancy. Some minor, probably unintentional, variation in the preparation

and plating of the panels may have seriously affected their behavior in one exposure but not in another.

That the preparation of the panels by the two Platers was not greatly different is indicated by the fact that for 23 sets exposed in Detroit, the correlation between Platers X and Y was 0.86. That any difference between X and Y in Kure Beach was confined principally to the sets containing a copper layer, is shown by the fact that while the correlation for the entire 23 sets was only 0.46, that for the 19 sets without copper was 0.83.

In the discussion of the paper from GMC[43] on dual chromium systems, the senior author stated that on steel these chromium coatings were effective only if a layer of copper preceded the bright nickel. No explanation was given, but it was suggested that the relation of the potentials of the various metals was involved.

Exposure tests have shown that in a marine location failure of many coatings is more rapid than in most industrial locations. Even so, it is important and frustrating that certain differences are observable only in one type of exposure. Hence, an accelerated test that is designed to predict behavior in one location, e.g., Detroit, does not necessarily indicate the relative performance in other locations.

2. **On zinc.** In addition to the above-stated reasons for applying an initial or intermediate layer of copper on steel, there is one other important purpose for using an initial layer of copper on zinc and zinc-base die castings. When zinc is immersed in slightly acid nickel baths, it tends to go into solution and to precipitate nickel in a spongy or powdery, non-adherent form. Any zinc that thus passes into the bath fosters the subsequent deposition of dark nickel deposits. As the throwing power of nickel plating baths is only fair, it is difficult to at once deposit nickel over the entire surface of a zinc casting with an irregular shape. Hence, the cyanide copper bath, with its excellent throwing power, is almost universally employed for the initial layer on zinc.

Actually, the greater difference in potential between copper and zinc than between copper and steel might be expected to accelerate corrosion of any exposed zinc. However, the importance of rapidly covering the zinc outweighs the possible harmful effects of a copper layer. It is not a question of whether the copper is desirable, but of whether there is any alternative.

It is possible to deposit adherent coatings of nickel on zinc from baths in which the nickel ion concentration has been reduced by citrates to form complex ions, or by sodium sulfate, a salt with a common ion. At Battelle[40] some panels were given a special nickel strike, followed by a layer of sulfamate nickel and of bright nickel, with 0.01 mil Cr, R. In accelerated tests these coatings were slightly superior to comparable coatings of copper, nickel and chromium. Some pitting was observed, and the authors concluded that more study is required before elimination of copper is justified. Recently the British Non-Ferrous Metals Research Association, BNFMRA,[47] reported that use of a high-sulfate nickel bath to deposit nickel directly on zinc did not increase the resistance to corrosion. They also found that marked variations in the surface condition of the die-castings had no significant effect on the quality of the coatings. For the present, we may assume that an initial layer of copper, usually about 0.4 mil, will be employed.

VIII. NICKEL DEPOSITS

1. Watts vs. bright nickel

Modern nickel plating is based largely on the Watts bath, proposed in 1916 by O. P. Watts, in which he demonstrated that higher current densities can be employed if the concentration of nickel is increased. The Watts bath was soon adopted by the rapidly growing automobile industry, and was generally employed for about 25 years. During this period its operation was improved by control of *p*H, temperature, and surface tension, and by filtration and removal of bath impurities. The deposits were "dull" and required buffing, which was costly, and which necessarily reduced somewhat the thickness of the nickel, and possibly even cut through it at certain points. In view of the present almost universal use of bright nickel baths, it may appear academic to discuss the performance of the dull deposits from the Watts bath. But it is important to compare the Watts and bright nickel deposits in order to throw light on the question raised early in this report, viz.: "Are bright nickel deposits inferior to the Watts coatings previously employed?"

There are not many quantitative comparisons of bright and dull deposits in recent publications. The accelerated tests now employed are different from the salt spray test used in early studies; and the exposure sites and methods of inspection and rating are different. Hence, it is difficult to make a direct comparison of the results of exposure tests made from 1932 to 1939 with those of the last decade.

In the first NBS study, reported in 1934,[5] Watts nickel was used principally, and it was concluded that the minimum thickness of the nickel was the most important factor in the protective value. The second NBS report in 1938[6] included panels plated in four proprietary bright nickel baths. The specimens were not separately identified, and the ratings for bright nickel were the averages for the four types. From the exposure tests it was concluded that "The proprietary bright nickel baths yielded, on the average, at least as much protection as plain nickel, but showed slightly more tendency to crack. . . . There was much more variation in the quality of the bright nickel than of the buffed plain nickel coatings. Evidently some of the bright nickel deposits were superior and others were inferior to comparable plain nickel deposits."

Inco[19, 20] reported that the ratings for steel coated with bright nickel and exposed for nine months at Kure Beach were distinctly lower than those of buffed dull nickel exposed there for 14 months.

The 1960 B-8 report[45] showed that with coatings on steel with 0.01 mil Cr, R, in Detroit the Ni, W showed some pitting and hence from the appearance ratings it was somewhat inferior to Ni, Br. From a protection standpoint the Ni, W and Ni, Br were about equal in Detroit. At Kure Beach the Ni, W was superior to Ni, Br in both ratings. With thicker coatings of Cr, R the two nickels were about equal, though in all cases the chromium was severely cracked.

BNFMRA reported[22] that in exposure in marine and industrial locations, steel panels plated with Watts, semi-bright, or bright nickel from freshly prepared baths, gave about the same performance. On zinc die-castings they found[23] that dull nickel was slightly more protective than bright nickel.

In use most commercial bright nickel baths change in composition, not only through depletion of certain constituents, but also through formation of decomposition products of the organic additions. BNFMRA reported[20, 21] that these changes may increase the stress and decrease the ductility of

the deposits and decrease the bright plating range. The contents of carbon, oxygen, hydrogen and nitrogen in the deposits also increased. No appreciable effects of the aging of the baths were found upon the protective value of the coatings in the sulfur dioxide test or in industrial or marine exposures.

In a recent study by Udylite[51] it was found that higher temperatures in the bright nickel baths generally decreased the brightness of the deposits but increased their ductility. The high-temperature deposits had a somewhat columnar structure, though their contents of carbon and sulfur were about the same as those of fully bright deposits.

Chrysler[46] reported results of exposure tests of steel and zinc die casting with a variety of coatings. They found that after one year's exposure of plated zinc in Miami, Detroit and Pittsburgh, the Watts nickel was about equal to the duplex nickel and superior to the average of 16 types of bright nickel.

Bright nickel from baths containing organic addition agents is usually less pure than nickel from a dull bath such as the Watts. It may contain appreciable amounts of carbon, oxygen, hydrogen, nitrogen, sulfur and chlorine, though the exact composition and location of the actual impurities have not been established.

Recently Harshaw[55] reported that a sulfo-oxygen organic control agent in a bright nickel bath is more completely reduced as a result of increased cathode polarization. Consequently, the sulfur is reduced and contributes sulfur (but not carbon) to the deposit. However, an organic control agent containing nitrogen contributes both nitrogen and carbon to the deposit. They suggest that the brightening action is similar to that of leveling, and is not primarily a result of small crystallite size.

The less pure bright deposits are therefore more susceptible to chemical or electrochemical attack in corrosive atmosphere. The bright deposits are usually less ductile than the dull coatings, and are hence more likely to crack when deformed or subjected to sudden changes in temperature. The finer grained (possibly sub-microscopic) structure of bright nickel also makes it more susceptible to attack. (Numerous researches in electrochemistry have shown that fine-grained metals have a more anodic potential than coarse-grained). The presence of laminations in most bright nickel deposits indicates that the impurities are not uniformly distributed, and may be in higher concentrations in one layer than in the adjacent layer. If so, there may be differences in potential between adjacent laminae, which may accelerate corrosion. In certain bright nickels the stress may be higher than in dull nickel unless stress reducing agents are used. Stresses may foster cracking, and also increase the susceptibility to chemical attack.

As previously suggested, the question as to whether, for a given thickness, bright nickel is inferior to Watts nickel is academic, since the economic benefits of bright nickel are so great that no one seriously suggests a return to buffed Watts nickel. What is important is that the industry is fully awake to the need for an improvement in nickel-chromium coatings, has done much research on methods of reaching this goal, and has made definite improvements.

2. Semi-bright nickel

In an effort to obviate some of the undesirable properties of bright nickel, Harshaw[35] developed in 1945 semi-bright baths, which yield deposits that are smooth, partly because of increased leveling action, and that require only a light color buffing to produce a bright surface. These deposits are free from sulfur, and have a columnar structure similar to Watts nickel. This bath* yielded deposits that were less subject to attack than bright nickel. It was used to a considerable extent, and came into wider use later, when it was employed as a constituent of duplex nickel coatings.

Not many references are available regarding the performance of coatings consisting only of semi-bright nickel. In studies by Udylite[44] it was found in exposure tests that a sulfur-free columnar type of Watts nickel, and a sulfur-free semi-bright nickel were both superior to bright nickel (all with 0.01 to 0.02 mil Cr, R). Harshaw[35] reported that when immersed in the acetic acid salt solution, or in the diluted Corrodkote slurry, semi-bright nickel is cathodic to bright nickel. The latter is dissolved about 40 times as fast as is the semi-bright nickel.

3. Duplex nickel

In early studies of B-8 Committee,[19] it was found that on steel with a given total thickness of nickel, much better protection was obtained at Kure Beach (but not in industrial locations) if the nickel deposit consisted of two successive layers of buffed dull nickel, instead of a single layer of buffed dull nickel. The sealing of any initial pores in the first nickel layer by the buffing operation was suggested as one cause of this difference in behavior. It is more probable that the nickel surface was finer grained than the remainder of the second layer. When nickel is deposited upon a buffed surface from which it is subsequently peeled, the bright surface is fine grained and behaves much like bright nickel. With the multiple layers of buffed dull nickel, the fine-grained nickel adjacent to the initial buffed surface may be more readily attacked than the coarser-grained nickel composing the bulk of the deposit. This relation will foster lateral corrosion of the fine-grained nickel and postpone penetration of the initial nickel layer.

There was no extensive application of duplex coatings with two layers of buffed dull nickel. From 1946 to 1952 Harshaw developed duplex coatings of semi-bright, sulfur-free nickel followed by a layer of bright nickel and a thin coating of Cr, R. Harshaw reported[26] that duplex nickel coatings with 0.01 mil Cr, R were consistently better than comparable bright nickel coatings on both steel and zinc castings in exposure tests in Florida, Detroit, Cleveland and Pittsburgh; and in Corrodkote, ACSS and CASS tests. With thicker coatings of Cr, R the duplex nickel was superior to bright nickel in the Corrodkote. They attributed the superior performance of the duplex nickel to the cathodic potential of the semi-bright nickel layer, which causes it to corrode less rapidly than the superposed bright nickel.

Recently Inco reported[61] that "the sulfur content in the deposits is a major factor in determining the relative electrochemical reactivities and pitting tendencies of nickel deposits."

Another factor that may contribute to the improved performance of the duplex nickel is the superior leveling action of the semi-bright layer. This effect may at least partly overcome the detrimental effects of surface roughness that have been reported by several authors.[57, 58] In a more recent paper[53] Harshaw reported that on steel specimens exposed at Kure Beach and Bayonne, and tested in Corrodkote and CASS, the duplex nickel was generally superior to the other coatings.

At Battelle[40] it was concluded that on zinc die-castings

*Designated as "Perflow."

duplex nickel is superior to bright nickel, provided that the semi-bright layer has a columnar structure, but not if it has a banded structure. Doehler[42] confirmed the results of Battelle and installed the "Doehler Double Plate" for production plating of zinc die-castings in 1957, and obtained favorable performance.

Udylite[28] found some discrepancies between the results of accelerated tests, roof exposure in Detroit, and mobile tests in Detroit and Chicago. Accelerated tests showed a marked superiority of duplex nickel on both steel and zinc castings. Roof exposure showed only a slight advantage of duplex nickel, while in mobile tests the duplex and bright nickel were about equal. In a more recent report[44] they concluded that with 0.01 mil Cr, R, duplex nickel is superior to bright nickel, but that more research and experience are needed.

The most extensive study of duplex nickel was conducted by Chrysler.[46] Exposure tests were conducted for one year at Miami, Detroit, and Pittsburgh of plated steel and zinc die-castings, all having a final layer of Cr, R. The zinc panels were all plated with 0.3 mil of copper and a total of 0.9 mil of nickel. Sixteen bright nickel processes were included, along with Watts and duplex nickel. Their results showed that on zinc the Watts and duplex nickel were about equal and were both much superior to bright nickel. The steel panels were all plated with 1.5 mil of total nickel and 0.01 mil of Cr, R. Some were exposed flat and some after bending. Twenty-eight bright nickel processes were included. The results showed that in each location the duplex nickel was superior to the bright nickel. Bending the panels had a decided adverse effect on the performance of the bright nickel, but not much on the duplex nickel. The authors showed by diagrams that the bright nickel coatings usually remained nearly perfect for only a few months, while the duplex coatings were nearly perfect at the end of one year.

The duplex nickel coatings have been more extensively applied in production than any of the other of the recent innovations, and with generally favorable results. It remains to be seen whether their advantages can be still further enhanced by modifications of the chromium layer.

IX. CHROMIUM DEPOSITS

1. Regular chromium

For many years thin chromium deposits, usually less than 0.02 mil, have been applied over buffed or bright nickel coatings. This usage was based on early observations[2, 3, 4] that from the conventional bath with a $\frac{Cr\,O_3}{SO_4}$ ratio of about 100, at temperatures from 35 to 50C (95 to 122F), and current densities from 100 to 150 amp/ft^2, chromium deposits less than 0.01 mil thick were porous; and those over 0.03 mil were cracked. Hence, the general practice is to deposit an average of about 0.02 mil, with a minimum of 0.01 mil. This practice was partly based on the assumption that the protective value of the composite coating was determined principally by the thickness and initial porosity of the nickel layer. The chromium surface was looked upon as purely decorative, owing to its resistance to tarnish. With the adoption of bright nickel, the evidence indicated that failure of the coatings was caused by attack of the nickel by the surrounding corrosive agents. This conclusion necessarily postulates permeability of the chromium layer, either through initial pores or cracks or those that may develop in service.

At present, most chromium plating is of the Cr, R type, deposited at relatively low temperatures and current densities and with a minimum thickness of 0.01 mil. There is a tendency to increase this thickness of Cr, R up to 0.03 mil, even though some cracks may develop. In the early NBS researches[5] it was concluded that: (1) Less than 0.01 mil of chromium usually reduced the protective value of the coatings; (2) coatings from 0.01 to 0.03 mil yielded about equal protection; (3) coatings from 0.05 to 0.1 mil Cr, R, yielded better protection. The latter observation, made in 1934, was apparently overlooked for some years. A slight benefit was also reported for chromium deposited at 35C (95F), or with a $\frac{Cr\,O_3}{SO_4}$ ratio of 200.

Many of the data on nickel coatings were obtained with 0.01 mil Cr, R. Battelle[40] reported that on zinc die-castings, 0.02 mil Cr, R was better than 0.01 mil, in exposures at Detroit and Kure Beach. GMC[34] reported a trend toward improved performance of coatings on steel if the Cr, R was increased up to 0.04 mil.

B-8 reported[45] that on steel, Cr, R deposits 0.03 and 0.06 mil thick were superior to 0.01 mil on both Watts and bright nickel in Detroit and Kure Beach. However, at both locations the thick Cr, R coatings developed a crazed appearance. They found no significant difference in performance of Cr, R deposited from the conventional bath and the proprietary SRHS bath (Cr-110), developed by United Chromium. (In this report we have designated both deposits as Cr, R.)

Udylite[26] reported that after one year's mobile service in Detroit, steel specimens with 1.0 mil Ni, Br plus 0.01 mil Cr, R were superior to those with 0.03 mil Cr, CF, a result not predicted by the CASS, Corrodkote or static roof tests. Doehler[39] made protracted CASS and Corrodkote tests on zinc die-cast panels coated with 0.4 mil copper and 0.8 mil duplex nickel, followed by different types of chromium. Some of the panels were baked after plating. The best, equally good, results were obtained with (a) 0.01 mil Cr, R; (b) 0.03 mil Cr, Du; and (c) 0.05 mil Cr, CF. No data on exposure tests were reported. Battelle[41] defined conditions for depositing pore-free and crack-free chromium. They used principally electrographic printing and the Corrodkote test to detect and define the porosity.

In general it is agreed that an increase in thickness of Cr, R up to about 0.03 mil is beneficial. Beyond that thickness cracking of the chromium may be objectionable, even though it does not always lead to basis metal corrosion.

2. Micro-cracked chromium

In the development of duplex chromium it was concluded that the final layer should have fine cracks, detectable only with a microscope. Conditions for depositing micro-cracked chromium were defined by several authors.[49, 52] Recently Battelle[48] announced that by the addition of a very small amount of selenic acid, e.g., from 0.007 to 0.02 g/l of H_2SeO_4, to a conventional chromic-sulfuric acid bath, the desired fine crack pattern can be readily obtained. They reported that 0.05 mil of Cr, Mc over copper and bright nickel on zinc die-castings gave favorable results in the CASS test. They suggest that its use may obviate the need for duplex chromium.

3. Crack-free chromium

During World War II in studies at NBS on the plating of gun barrels it was found[8, 9] that chromium deposited from conventional baths at high temperatures and current densities contains less oxygen and is softer than Cr, R. It is relatively

free from cracks, even when heated to elevated temperatures. The term "low contraction chromium" was applied to these deposits.

In 1953 United Chromium[13] described the deposition of similar chromium from the SRHS bath, to which they applied the name "crack-free chromium". This deposit was dull and required buffing. In 1957 Metal and Thermit[15] reported the deposition of "bright crack-free chromium" and stated that in accelerated and exposure tests it yielded better performance than Cr, R. They employed CASS and Corrodkote and roof exposure in Detroit.

Udylite[17] deposited Cr, CF at 55C (131F) and 300 am/ft^2 from baths containing 250 g/l CrO_3 and a ratio of from 125 to 150. Over bright nickel on steel, Cr, CF at least 0.03 mil thick gave better protection than 0.01 mil Cr, R in ACSS, Corrodkote, and one year's roof exposure in Detroit. Over Watts nickel there was little difference in the behavior of the two types of chromium.

Metal and Thermit[27] showed by photographs that with coatings of Cr, CF up to 0.08 mil the protection increased with thickness in CASS, Corrodkote and Detroit roof exposure, whereas with Cr, R the protection decreases above 0.02 mil. Harshaw[28] found that thick coatings of Cr, CF yield better protection than does 0.01 Cr, R on both Ni, Br and Ni, Du.

B-8[45] reported that in Detroit and Kure Beach thick chromium yields better protection on both Ni, W and Ni, Br. There was no difference in protection between Cr, R and buffed Cr, CF, but the Cr, R developed a crazed appearance and the Cr, CF did not. Metal and Thermit[37] reported that on zinc die-castings, coatings of Cr, CF up to 0.07 mil showed much better protection than 0.01 mil Cr, R in CASS, Corrodkote, and Detroit roof exposure. With Cr, CF there were fewer but larger blisters than with 0.01 mil Cr, R. Battelle[40] found that with 0.4 or 0.8 mil Ni, Du on zinc die castings, 0.055 mil Cr, CF gave a much better performance than did 0.01 mil Cr, R. The Cr, CF did not show the corrosion pits that were observed with the Cr, R.

Doehler[39] deposited several types of chromium over 0.4 mil copper and 0.8 mil Ni, Du on zinc die castings. They used electrographic printing to reveal cracks in the chromium. They subjected the panels to five cycles each in the CASS and Corrodkote, both before and after baking. As above noted, the best, equally good, results were obtained with (a) 0.01 mil Cr, R; (b) 0.03 mil Cr, Du; and (c) 0.05 mil Cr, CF. Some surface pitting and cracking were observed on all the coatings. Udylite[44] concluded that on steel 0.03 mil Cr, CF over 1 mil of Ni, Br, or over 1 mil of Cu + Ni, Br, does not give the desired outdoor service in northern industrial cities that use sodium chloride to de-ice the streets. However, with 1.5 to 2 mil Cu + Ni, Br, 0.03 mil Cr, CF shows a great improvement.

In general it is agreed that thick deposits of Cr, CF are superior to 0.01 mil Cr, R, but the Cr, CF coatings tend to craze or crack in service, and any corrosion spots that do occur may be larger.

4. Duplex chromium

In an effort to retain but improve on the benefits of Cr, CF, Metal and Thermit[37, 52, 59] and GMC[49] developed duplex chromium. This consists of a layer of Cr, R or Cr, CF, followed by a layer of bright but finely cracked chromium, Cr, Mc. Equal thicknesses of each are used. The following results were obtained by Metal and Thermit in CASS and Corrodkote. On zinc die-castings plated with 0.75 mil Cu and 0.75 mil Ni, Br, much less corrosion was observed with 0.05 mil Cr, Du in four CASS or six Corrodkote cycles than in two cycles for panels with 0.01 mil Cr, R. Similar results were obtained with steel panels and car parts. Until exposure tests are completed, it is difficult to assess the value of these prolonged accelerated tests.

In the GMC studies on steel[49] the recommended duplex chromium deposits consisted of 0.015 mil Cr, R plus 0.015 mil Cr, Mc, over from 0.3 to 1 mil Cu, Cn + Cu, A; and 0.5 to 1.2 mil Ni, Br. CASS test and roof exposures showed that these deposits yield superior corrosion resistance.

While no measurements of the reflectance of the various types of chromium coatings have been published, several investigators have reported informally that the micro-cracked and duplex chromium coatings do not have as high an initial luster as does a thin layer of regular chromium. It has also been reported that in accelerated and static exposure tests these modified chromium deposits develop haziness.

5. Sandwich chromium

In 1958 Inco[24] reported results of studies on intermediate layers of various metals. They concluded that a layer of chromium between two layers of nickel was the most beneficial in exposures at Kure Beach and Bayonne. Udylite[30] confirmed this conclusion and reported that in Detroit improvement was obtained on steel with successive layers of Cr, R; Ni, Br; and Cr, R; and on zinc with Cu; Cr, R; Ni, Br; and Cr, R. No practical applications of this sandwich chromium have been reported.

X. SUGGESTIONS

This title has been employed for this section, rather than "recommendations" because it is fully realized that many of the ideas here suggested (as well as many thought of by others interested in this field) may prove fruitless. The opportunity for improvement is so great that consideration may well be given to all ideas that hold any promise.

1. Preparation of specimens

It may be advisable to produce all deposits in freshly prepared or purified solutions, even though such coatings may not reproduce closely those made in production. In certain bright nickel baths it may be expedient to prepare sets of specimens at intervals, measured in amp/gal, to determine the effects of aging the solutions. An effort should be made to develop more stable baths, even at some compromise of properties. It is better to produce consistently, both for test and service, coatings that are nearly alike, though only 90 per cent as good as the maximum attainable, than to obtain deposits that range from 100 to 50 per cent of the maximum.

2. Accelerated tests

Closer control of all possibly significant factors is desirable. In the spray tests no study has been reported on the effects of particle size in the fog, and its rate of movement, both of which may affect the rate of settling. The same rate of settling may be obtained with a relatively small number of large liquid droplets as with a larger number of finer particles. One way to detect a difference in the fog structure is by some form of nephelometer, e.g., by measuring the distance through which a light of known intensity can be seen. It is not

suggested that such measurements be made a part of the control, but they may serve to determine whether such differences affect the rate of failure of the coatings.

In the Corrodkote test no data have been reported on the conditions for drying the slurry coated specimens. It is obvious that the slurry will dry more rapidly in air with a low humidity and high temperature than under reverse conditions. Rapid drying of kaolin may produce a nearly impermeable film through which water vapor may not readily pass. If so, the concentration of corroding solution adjacent to the metal surface may vary widely. Suitable tests on the rate of drying of the slurry and parallel effects in corrosion tests will show whether this variable is significant.

In both the Corrodkote and sulfur dioxide tests the control of the humidity is difficult, especially between 90 and 100 per cent. It may be helpful to pass the incoming air through water at a selected lower temperature that will yield the desired humidity at the temperature of the box.

The solution used in the Corrodkote slurry contains 0.7 g/l of $Cu(NO_3)_2 \cdot 3\ H_2O$; 3.3 g/l of $FeCl_3 \cdot 6\ H_2O$; and 20 g/l of NH_4Cl. The vapor pressure of this solution is less than that of pure water, hence the slurry tends to absorb water if the prevailing humidity is, for example, 90 per cent. The resultant solution which causes attack of the coating, does not, except accidentally, have the same concentration as the original slurry. Its concentration will depend upon the extent of the original drying and the rate of absorption of moisture. The addition of a small amount of a more hygroscopic substance such as calcium chloride may insure more rapid and more uniform absorption of water vapor. Calcium chloride is no longer used extensively for de-icing streets, but neither is ammonium chloride. A few tests should suffice to learn whether a slurry containing calcium chloride is advantageous.

3. Rating methods

The various phenomena observed in the performance of plated coatings cannot be fully expressed by a single rating number. Each rating should represent the objective judgment of the inspector. Such judgments involve personal opinions regarding the importance of each type of failure. It is customary at each inspection to hold a conference at which any serious discrepancies are discussed. This may result in a change in ratings when it is agreed by all that, for example, set A is better than set B. No inspector should be asked or permitted to change his rating unless his reconsideration warrants such a change. When possible the inspectors should agree closely on the order of quality of the coatings, even if not on their exact ratings.

4. Electrochemical factors

There is ample evidence[12, 14] that failure, especially of composite coatings, is related to or caused by differences in potential prevailing between dissimilar metals, and different forms of each metal. Static potentials in such systems are subject to changes in magnitude or even in direction as a result of minor and possibly undetectable changes in environment. Measurements of dynamic potentials and polarization and of the resultant current are more likely to explain or predict the performance of these complicated systems.

In a recent study by Harshaw[53] static potentials were measured of various metals and couples in salt solutions and in diluted Corrodkote slurry. The results showed that chromium is generally more noble than Watts nickel, and that Watts nickel and semi-bright, sulfur-free nickel are more noble than bright nickel. But there were unexplainable variations and even reversals that hinder any adequate interpretation of the data. Similar results were obtained at NBS.[62] Polarization measurements may be more significant. In a recent paper by Metal and Thermit[52] it is pointed out that the order in any practical galvanic series depends upon whether under the prevailing conditions the nickel and chromium are active or passive.

The AES Research Committee has just initiated Project 19, to be conducted at the National Bureau of Standards, upon "Galvanic Effects Associated with Coating Failures." It is hoped that this and other studies will throw light on this at present confused problem.

Numerous sectional photographs[20] indicate that improved performance with certain modifications depends not so much on decreasing the total attack of the nickel, as on changing from a vertical, penetrating attack to a lateral corrosion of one or more layers. Thereby the probability of basis metal attack is reduced.

FUTURE RESEARCHES

ASTM Committee B-8 is now planning exposure programs V and VI. It is hoped that both static and mobile tests will be made, and that parallel accelerated tests will be made through cooperation with AES Project 15. Cooperation is fostered by the presence of many of the same persons on these two committees.

To insure that important variables are not overlooked, B-8 might well draft a "master plan" in which future studies might be suggested well in advance of their initiation. Different programs should include a few "standard" sets that may serve to "calibrate" the prevailing exposure conditions.

XI. ACKNOWLEDGMENTS

This survey was expedited by the cordial cooperation of many of the authors of the papers listed in the bibliography, who kindly supplied reprints or manuscripts of their publications, and have submitted helpful editorial suggestions.

Information regarding European plating practice was furnished by the following persons: A. Dias Santilhano, L. Van der Hoorn, Utrecht, Holland; Ferrucio Enrico, Fiat L.R.C.A.A., Turin, Italy; A. E. Matthes, Langbein-Pfanhauser Werke, Neuss, Rhein, Germany; E. Hermann, Volkswagenwerke, Wolfsburg, Germany.

The International Nickel Co. initiated and supported this survey. To all the above persons and firms the author extends hearty thanks.

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SUPPLEMENT

Use of Spearman's Equation to Compute Correlation Coefficients

Spearman's equation is: $\rho = 1 - \frac{6\Sigma D^2}{N(N^2 - 1)}$

in which ρ = the correlation coefficient

D = the difference in rank of a given set in the two columns compared.

N = the number of sets being compared.

The application of this formula is illustrated by the following table, based on purely fictitious values.

Set	Accel. Test Order	Expos. Test Order	D +	D −	D^2
A	1	2		1	1
B	3	4		1	1
C	5	3	2		4
D	6	6	0		0
E	2	1	1		1
F	7	5	2		4
G	4	10		6	36
H	8	7	1		1
I	10	9	1		1
J	9	8	1		1
		Sum	8	8	50

$$\rho = 1 - \frac{6(50)}{10(10^2 - 1)} = 1 - \frac{300}{990} = 1 - 0.30 = 0.70$$

A single large divergence in rank in comparable columns has a much greater effect on the correlation coefficient than has a number of smaller differences. The computations are simplified by certain conventions. If in one column three ratings are equal, e.g., each R = 10, they are each given a rank of 2. If four such ratings are equal, they should all receive an order number of 2.5. Actually, little error is made if in that case two sets are each given a rank of 2 and each of the other two sets is given a rank of 3; and the use of fractions in the computations is avoided. If N = 10 or more, the omission of the −1 in the denominator will affect the value of ρ by one per cent or less, i.e., be insignificant. For practical purposes the equation may be simplified to read:

$$\rho = 1 - \frac{6\Sigma D^2}{N^3}$$

Such computations are not significant for small numbers of comparable tests, as then a single relatively large divergence may make the coefficient equal to zero, or even negative. For this reason the computations were confined to reports in which at least eight sets were compared.

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Dr. William Blum received his undergraduate degree and his PhD from the University of Pennsylvania. He joined the National Bureau of Standards in Washington, D. C. in 1909 after teaching chemistry at the University of Utah for several years. He was chief of the NBS Electrodeposition Section from 1917 to 1951, when he retired.

Dr. Blum has authored many technical papers as well as the book, "Principles of Electroplating and Electroforming," which he wrote with George B. Hogaboom. He belongs to many technical societies including AES, Electrochemical Society, ASTM. He has been awarded an honorary degree from the University of Pennsylvania, honorary membership in the AES and Institute of Metal Finishing and has received various medals. Among these are the American Institute of Chemists' medal for "Distinguished Government Service", the U. S. Department of Commerce medal for "Outstanding Contributions to Science," the Acheson Medal of the Electrochemical Society, the Cresson Medal of Franklin Institute, and the Hothersall Medal of the Institute of Metal Finishing. Dr. Blum was the first winner of the AES Scientific Achievement Award.

He has served as an advisor to the War and Navy Departments and since 1951 has been a consultant to Frankford Arsenal in Philadelphia and Rock Island Arsenal in Illinois.

THE INFLUENCE OF THE PHYSICAL METALLURGY AND MECHANICAL PROCESSING OF THE BASIS METAL ON ELECTROPLATING

VII. The Effect of Chemical Treatment of a Steel Base on the Corrosion Performance of a Watts Nickel Deposit

by M. H. JONES* and J. SAIDDINGTON**

A study has been made of the effect that different chemical treatments of a ferrous base have on the corrosion performance of a one mil Watts nickel deposit. The treatments investigated were those commonly employed in the industry, including simple acid dips, anodic etches and electropolishing, and they were compared using surface conditions that had been shown previously to be detrimental to good durability. A laboratory prepared surface was used as a reference.

With poor surface conditions, of which extension close to the fracture point of the steel after polishing and coarse commercial greased belt polishing were chosen as examples, no clear distinction was found between the various treatments in statistically designed experiments, although the electrochemical treatments showed a trend towards better performance than the simple acid dips.

With a well prepared surface (laboratory polishing), anodic etches involving moderate stock removal gave similar corrosion results to acid dips which do not attack the surface significantly. However, extensive electropolishing was found to result in very poor durability of the deposit and this is surprising in view of the fact that a smooth distortion free surface is generally regarded to be the optimum condition for plating. The probable explanation of this phenomenon has come from a metallographic study of the basis metal-deposit interface.

INTRODUCTION

During the past five years AES Research Project No. 14 has been engaged in a detailed study of the influence of basis metal variables on the corrosion performances of nickel deposits. The work has been confined to ferrous bases and has included such factors as the nature and composition of steels,[1] the effect of mechanical polishing[2] and the influence of stretching,[3] a condition that is encountered in all forming or drawing operations to produce an article of particular shape. The implication of this series of investigations has been that, for the most part, corrosion effects attributable to the base are concerned primarily with the surface layer. In consequence, it should be possible to reduce or eliminate them by suitable chemical treatments prior to plating.

In the earlier studies a very mild treatment was used, consisting of a dip in dilute sulfuric acid after degreasing and an anodic alkaline clean, since the interest was centered on the effect of the base and this treatment gave good adhesion consistent with a minimum attack on the surface. In the present work a number of different chemical and electrochemical treatments have been compared for their effect on the durability of a Watts nickel deposit, using basis metal conditions that are known to give poor durability. For practical reasons, the treatments chosen were those commonly used in the plating industry and included some in which the nature of the basis metal surface is changed by appreciable stock removal.

TREATMENTS AND BASIS METAL CONDITIONS

Five basic chemical treatments were selected for this investigation. Four of these were carried out for two different periods of time and details of the conditions are listed in Table I. Where the term 'chemical treatment' is used, apart from a water rinse, it refers to the last step of basis metal preparation prior to plating. In all cases, treatments were preceded by a trichloroethylene degrease and an anodic alkaline clean (NaOH, 45 g/l; Na_2CO_3, 30 g/l; temp 80C; cd, 100 asf for 1.5 min).

It was considered that the best method of evaluating such treatments was to compare their action on a given basis metal having different surface conditions. An aluminum killed steel (Analysis: C, 0.07; Mn, 0.35; P, 0.009; S, 0.023; Tensile Strength along rolling direction, 44,600 psi; across

TABLE I
CHEMICAL TREATMENTS

No.	Type	Time	CD (asf)
1	8% H_2SO_4 dip—room temperature	15 sec	
2	6% HCl dip—room temperature	1 min	
3	6% HCl dip—room temperature	5 min	
4	25% H_2SO_4 anodic etch—room temperature	15 sec	200
5	25% H_2SO_4 anodic etch—room temperature	45 sec	200
6	75% H_2SO_4 anodic etch—room temperature	30 sec	100
7	75% H_2SO_4 anodic etch—room temperature	90 sec	100
8	Electropolish*—50C	1 min	150
9	Electropolish*—50C	5 min	150

*U. S. Patent No. 2,338,321: 15% H_2SO_4, 63% H_3PO_4, 10% CrO_3, 12% H_2O.

*Project Director, Department of Chemistry, Ontario Research Foundation, Toronto, Canada.
**Research Associate (formerly J. Zajdowski).

TABLE II
TYPE OF SURFACE FINISH

Designation	Type	Stock Removal (mils)	Surface Finish RMS (μ in.)
S	Standard Surface—Laboratory Polishing	0.1	9–11
E	Extended Surface—Laboratory Polished and Stretched 30%	0.1	65–80*
P	Commercial Surface—Grease Belt Polishing	2–3	35–45

*For explanation of increase in surface roughness on stretching see Ref. 3.

rolling direction, 44,000 psi) was chosen as this material had been used in earlier experiments on the effect of polishing[2] and stretching.[3] The three types of surface finish studied are listed in Table II. The standard surface, S, was selected as a control since it had been found to give reproducible results of optimum performance in previous investigations. The two finishes chosen for comparison, E and P, had shown comparatively poor durability in tests in which a simple acid dip was used as the chemical treatment.[2, 3]

As the different chemical treatments have a wide range of stock removal from the surface, this factor was studied before corrosion experiments were undertaken. The rates of stock removal for the treatments are shown in Fig. 1. With the simple acid dips the amount of metal dissolved is negligible up to periods of at least five minutes and this was also apparent from microscopic examination of the surface. The electrochemical treatments show appreciable metal solution, the highest rate being obtained with electropolishing. As is well known, this treatment has a pronounced smoothing effect on the surface contour.

PREPARATION OF SPECIMENS AND TESTING

All specimens (0.62 by 1.5 in.) were obtained from panels taken from the same sheet of steel using a random method of sampling. Specimens with the standard finish, S, were prepared by individual hand polishing on a No. 2 metallographic emery paper. The extended specimens, E, were cut from tensile test pieces which were first polished transversely to the standard finish and then extended by approximately 30 per cent of the original length. The commercially polished specimens were cut from 4 by 8 in. panels which were prepared in a belt type operation using belts containing alumina abrasive and lubricated with tallow.*

The specimens were plated in sets in a symmetrical arrangement[2] in a Watts bath ($NiSO_4 \cdot 6H_2O$, 240 g/l; $NiCl_2 \cdot 6H_2O$, 45 g/l., H_3BO_3, 30 g/l; *p*H, 2.0 electrometric; temp, 55 ± 1C; cd, 36 asf) to an average thickness of 1 mil.

For corrosion testing the Corrodkote test[4] was employed. Specimens were examined after exposure periods of 4, 16, 24 and 48 hours and appraised by counting the number of corrosion failures visible at 100× magnification under a binocular microscope. Examination at the 4th and 16th hour period was made with the Corrodkote paste intact. After 24 hours of exposure the specimens were washed with distilled water, appraised and subjected to a further 24 hours of test after the application of fresh paste. It was noted in certain cases that counts made immediately prior to the removal of the paste were lower, indicating that some corrosion failures had not developed sufficiently to give a visible rust stain in the paste film.

*Courtesy of W. M. Tucker, Roll Coating Division, Eastman Kodak, Rochester, New York.

EXPERIMENTAL DESIGN

The specimens were arranged randomly into sets, each set containing one sample of each type of surface finish. Existing facilities permitted the plating of five sets (15 specimens) at one time and two platings were made for each treatment. Hence a total number of 90 sets or 270 specimens were processed. The arrangement for dividing the sets between treatments, platings and tests is given in Table III.

Sets were kept as units throughout the procedure as the evaluation of a given chemical treatment was to be based primarily on its performance in relation to different surface finishes. As the large number of specimens required the corrosion testing to be carried out in two runs, the sets were divided into equal lots. Each lot contained sets from the same plating to overcome the effect of a plating-test interaction. In addition, as each plating contained an odd number of sets, the ten sets from the two platings for a given treatment were divided between tests on the basis of odd and even numbers (see Table III). A standard randomization scheme was adopted for the location of specimens within the plating bath and for the order of platings.

As previous investigations[2, 3] had shown that there can be a significant variation from plating to plating and, for practical reasons, sets of specimens subjected to a wide range of chemical treatments cannot be plated simultaneously, it follows that the comparison of treatments on the same surface finish will be confounded with plating variability. Thus it is difficult to accurately assess the effect of different treatments on a given finish in this particular case. In an additional experiment, described later, which was designed to obtain a direct comparison of hydrochloric and sulfuric acid dips of the same duration, this problem was avoided.

In the treatment of the corrosion data the counts of corrosion failures were transformed to square roots of counts to try to satisfy the condition of a uniform error variance for a given experiment and were then subjected, as a whole, to a detailed analysis of variance.

CORROSION PERFORMANCE FOR DIFFERENT CHEMICAL TREATMENTS

The development of corrosion failures followed a regular trend throughout the tests and the counts on individual speci-

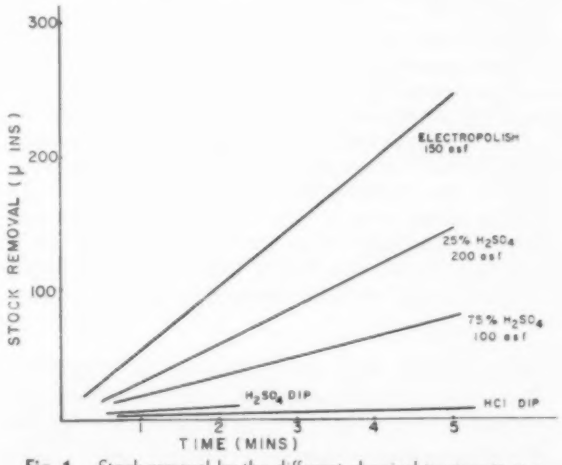

Fig. 1. Stock removal by the different chemical treatments as a function of time.

mens for all treatments at the 4 and 24 hour exposure periods are compiled in Table IV. It is apparent that the pattern of corrosion performance is established early in the test and that there appears to be a trend for the standard surface, S, to give better durability than the extended and commercially polished surfaces, E and P, for all treatments except the five minute electropolish.

An analysis of variance for the whole data at the 24 hour exposure period, based on the square roots of counts, is given in Table V. There are two important observations to consider.

Firstly, there are significant differences in durability between finishes at the one per cent level, i.e. the probability of such differences being due to chance is less than one in 100. Secondly, there is a significant interaction between chemical treatments and finishes. This implies that differences between treatments do exist, although treatments as such do not appear as a significant source of variation in the analysis. This is due to the method of calculation which involves pooling the data from the three different finishes. The apparent anomaly can be appreciated more easily by inspection of the original counts which show that while one finish benefits from a particular treatment, another deteriorates, so that the overall picture is one in which there is no apparent effect of treatment.

There is also a significant interaction between finishes and tests which implies that the various finishes have reacted in a different direction towards the two tests.

To obtain more detailed information on the relationship between finishes for a given treatment, analyses of variance were made for finishes, platings and tests within each individual treatment. These are reported in the first section of Table VI where it can be seen that there is a trend towards differences in performance between finishes for almost all the treatments (as shown by high F values), although they are only significant above the five per cent level for the one minute hydrochloric acid dip and the five minute electropolish. In these two cases the effect is due to the poor durability of the extended and commercially polished surfaces with the acid dip and a similar behaviour for the standard surface with the electropolishing treatment. To illustrate these results more clearly the average square root counts of corrosion failures for the different finishes are plotted in the form of a bar chart in Fig. 2. The length of the arrow for each treatment represents a difference that is statistically significant at the five per cent level.

To evaluate the relative response of the different chemical treatments to each surface finish, a third series of analyses were made and the results are given in the second section of Table VI. Only with the standard surface is the difference between treatments above the chosen significance level (five per cent). However, to illustrate trends, the performances of the treatments for the different surface finishes are plotted in Figs. 3, 4 and 5. The most surprising observation is the very poor durability of the standard surface when subjected to a five minute electropolish (treatment 9), especially in comparison to its performance for an electropolishing time of one minute (treatment 8). The probable explanation of this behaviour has come from a microscopic study of the interface between the basis metal and the deposit for the different

TABLE III

SCHEMATIC ARRANGEMENT OF PLATINGS, TREATMENTS AND TESTS

Order of Plating	Platings		Sets*	Tests I	Tests II
i	1	No. 1—8% H_2SO_4—15 sec dip	1–5	1, 3, 5	2, 4
l	2		6–10	7, 9	6, 8, 10
j	3	No. 2—6% HCl—1 min dip	11–15	11, 13, 15	12, 14
m	4		16–20	17, 19	16, 18, 20
k	5	No. 3—6% HCl—5 min dip	21–25	21, 23, 25	22, 24
n	6		26–30	27, 29	26, 28, 30
a	7	No. 4—25% H_2SO_4—Anodic Etch 15 sec	31–35	31, 33, 35	32, 34
b	8		36–40	37, 39	36, 38, 40
c	9	No. 5—25% H_2SO_4—Anodic Etch 45 sec	41–45	41, 43, 45	42, 44
d	10		46–50	47, 49	46, 48, 50
f	11	No. 6—75% H_2SO_4—Anodic Etch 30 sec	51–55	51, 53, 55	52, 54
h	12		56–60	57, 59	56, 58, 60
e	13	No. 7—75% H_2SO_4—Anodic Etch 90 sec	61–65	61, 63, 65	62, 64
g	14		66–70	67, 69	66, 68, 70
o	15	No. 8—Electropolish—1 min	71–75	71, 73, 75	72, 74
r	16		76–80	77, 79	76, 78, 80
p	17	No. 9—Electropolish—5 min	81–85	81, 83, 85	82, 84
q	18		86–90	87, 89	86, 88, 90

*Each set containing one each of S, E and P.

TABLE IV

CORROSION DATA FOR TREATMENTS 1-9

(No. of Failures per Specimen)

Four Hours Exposure

	Test I						Test II						
Treatment 1—8% H_2SO_4—15 Sec Dip													
	Plating 1			Plating 2			Plating 1		Plating 2				
Set No.	1	3	5	7	9	Total	2	4	6	8	10	Total	Sum of Totals
S	0	2	1	1	0	4	0	0	0	1	3	4	8
E	3	2	1	1	0	7	2	3	3	2	4	14	21
P	11	0	2	0	0	13	1	0	1	2	2	6	19
Treatment 2—6% HCl—One Min Dip													
	Plating 3			Plating 4			Plating 3		Plating 4				
Set No.	11	13	15	17	19	Total	12	14	16	18	20	Total	
S	3	0	1	2	0	6	1	0	2	0	0	3	9
E	10	8	7	3	2	30	3	15	3	7	0	28	58
P	21	6	11	5	8	51	1	3	1	0	2	7	58
Treatment 3—6% HCl—Five Min Dip													
	Plating 5			Plating 6			Plating 5		Plating 6				
Set No.	21	23	25	27	29	Total	22	24	26	28	30	Total	
S	1	0	1	2	0	4	1	1	0	0	1	3	7
E	1	5	4	0	1	11	3	3	1	1	6	14	25
P	17	20	16	0	0	53	34	25	2	4	2	67	120
Treatment 4—25% H_2SO_4—Anodic Etch—15 Sec													
	Plating 7			Plating 8			Plating 7		Plating 8				
Set No.	31	33	35	37	39	Total	32	34	36	38	40	Total	
S	3	0	3	1	2	9	0	1	0	0	1	2	11
E	4	3	1	3	5	16	1	3	1	1	2	8	24
P	3	2	5	0	6	16	3	3	1	5	2	14	30
Treatment 5—25% H_2SO_4—Anodic Etch—45 Sec													
	Plating 9			Plating 10			Plating 9		Plating 10				
Set No.	41	43	45	47	49	Total	42	44	46	48	50	Total	
S	0	0	3	2	1	6	0	0	0	0	0	0	6
E	1	0	1	0	3	5	1	1	0	1	0	3	8
P	2	5	2	2	3	14	1	1	0	1	3	6	20
Treatment 6—75% H_2SO_4—Anodic Etch—30 Sec													
	Plating 11			Plating 12			Plating 11		Plating 12				
Set No.	51	53	55	57	59	Total	52	54	56	58	60	Total	
S	0	0	1	1	1	3	1	1	0	0	2	4	7
E	1	1	4	1	1	8	2	3	0	0	0	5	13
P	2	4	1	2	2	11	0	3	1	0	3	7	18
Treatment 7—75% H_2SO_4—Anodic Etch—90 Sec													
	Plating 13			Plating 14			Plating 13		Plating 14				
Set No.	61	63	65	67	69	Total	62	64	66	68	70	Total	
S	0	1	0	2	5	8	2	0	1	1	1	5	13
E	1	2	2	6	9	20	1	1	2	1	5	10	30
P	2	3	2	4	7	18	2	1	4	1	8	16	34

TABLE IV (Continued)

CORROSION DATA FOR TREATMENTS 1-9

(No. of Failures per Specimen)

Four Hours Exposure

	Test I						Test II						
Treatment 8—Electropolish—One Min													
	Plating 15			Plating 16			Plating 15		Plating 16				
Set No.	71	73	75	77	79	Total	72	74	76	78	80	Total	
S	2	0	0	0	3	5	1	0	7	2	3	13	18
E	1	3	0	2	3	9	4	0	4	3	6	17	26
P	0	0	0	1	1	2	2	1	0	0	5	8	10
Treatment 9—Electropolish—5 Min													
	Plating 17			Plating 18			Plating 17		Plating 18				
Set No.	81	83	85	87	89	Total	82	84	86	88	90	Total	Sum of Totals
S	21	7	3	7	23	61	8	5	10	18	13	54	115
E	6	1	0	1	0	8	4	1	0	2	1	8	16
P	2	2	3	2	1	10	2	0	2	0	4	8	18

24 Hours Exposure

Treatment 1—8% H_2SO_4—15 Sec Dip													
	Plating 1			Plating 2			Plating 1		Plating 2				
Set No.	1	3	5	7	9	Total	2	4	6	8	10	Total	
S	0	2	2	1	1	6	0	0	0	1	4	5	11
E	3	2	1	0	0	6	3	3	3	3	5	18	23
P	11	0	3	0	0	14	1	1	3	2	5	12	26
Treatment 2—6% HCl—One Min Dip													
	Plating 3			Plating 4			Plating 3		Plating 4				
Set No.	11	13	15	17	19	Total	12	14	16	18	20	Total	
S	3	0	2	2	1	8	2	0	2	0	0	4	12
E	12	9	7	2	2	32	4	15	2	8	0	29	61
P	21	6	12	6	9	54	1	2	3	2	2	10	64
Treatment 3—6% HCl—Five Min Dip													
	Plating 5			Plating 6			Plating 5		Plating 6				
Set No.	21	23	25	27	29	Total	22	24	26	28	30	Total	
S	1	0	1	3	0	5	2	1	1	1	1	6	11
E	3	6	5	1	5	20	4	5	2	2	7	20	40
P	22	21	17	0	4	64	50	25	2	5	3	88	149
Treatment 4—25% H_2SO_4—Anodic Etch—15 Sec													
	Plating 7			Plating 8			Plating 7		Plating 8				
Set No.	31	33	35	37	39	Total	32	34	36	38	40	Total	
S	3	0	4	2	2	11	0	1	0	1	1	3	14
E	4	3	1	3	5	16	1	3	1	1	3	9	25
P	4	2	6	1	7	20	2	2	0	5	2	11	31
Treatment 5—25% H_2SO_4—Anodic Etch—45 Sec													
	Plating 9			Plating 10			Plating 9		Plating 10				
Set No.	41	43	45	47	49	Total	42	44	46	48	50	Total	
S	0	0	4	2	2	8	0	0	0	0	0	0	8
E	1	0	1	0	3	5	1	0	0	2	1	4	9
P	2	4	3	2	3	14	0	1	1	1	3	6	20

(Continued on the next page)

TABLE IV (Continued)

24 Hours Exposure

	Test I						Test II						
Treatment 6—75% H_2SO_4—Anodic Etch—30 Sec													
	Plating 11			Plating 12			Plating 11		Plating 12				
Set No.	**51**	**53**	**55**	**57**	**59**	**Total**	**52**	**54**	**56**	**58**	**60**	**Total**	
S	0	0	2	1	1	4	1	1	1	0	2	5	9
E	1	0	3	1	3	8	3	4	1	1	0	9	17
P	2	4	1	2	2	11	1	6	1	2	3	13	24
Treatment 7—75% H_2SO_4—Anodic Etch—90 Sec													
	Plating 13			Plating 14			Plating 13		Plating 14				
Set No.	**61**	**63**	**65**	**67**	**69**	**Total**	**62**	**64**	**66**	**68**	**70**	**Total**	
S	0	2	0	3	7	12	1	1	1	2	1	6	18
E	1	2	1	7	10	21	0	1	4	1	6	12	33
P	4	3	2	5	6	20	2	1	5	3	9	20	40
Treatment 8—Electropolish—One Min													
	Plating 15			Plating 16			Plating 15		Plating 16				
Set No.	**71**	**73**	**75**	**77**	**79**	**Total**	**72**	**74**	**76**	**78**	**80**	**Total**	**Sum of Totals**
S	2	0	0	0	3	5	1	0	11	5	3	20	25
E	1	4	0	2	3	10	5	0	7	7	10	29	39
P	0	0	0	2	1	3	3	1	2	0	5	11	14
Treatment 9—Electropolish—Five Min													
	Plating 17			Plating 18			Plating 17		Plating 18				
Set No.	**81**	**83**	**85**	**87**	**89**	**Total**	**82**	**84**	**86**	**88**	**90**	**Total**	
S	23	7	5	16	29	80	10	7	18	20	15	70	150
E	5	1	0	1	1	8	4	2	0	4	1	11	19
P	2	1	4	3	1	11	1	1	2	1	8	13	24

chemical treatments and surface finishes, and is referred to later. It is also of interest to note from Figs. 3, 4 and 5 that the anodic etch with 25 per cent sulfuric acid (treatment 5) generally shows lower corrosion rates than the other treatments, although the differences are not statistically significant.

Complete analyses of variance were also made on the 4- and 48-hour data. Apart from isolated cases of a change in the significance level, which is to be expected from the variability of replicate samples, the pattern of performance for the various finishes with different chemical treatments was found to be essentially the same for all three exposure periods. This adds confidence to the interpretation placed on the results for the 24-hour exposure period. In addition, it is apparent that the 4-hour data gives basically all the informa-

TABLE V

GENERAL ANALYSIS OF VARIANCE FOR CORROSION DATA OF TREATMENTS 1-9

(24 Hours Exposure, Sq Roots of Counts)

Source of Variation	Sum of Squares of Deviations	Degrees of Freedom	Mean Square	F
1) Between Platings	83.73	17	4.925	
2) Between Treatments	47.60	8	5.951	1.48
3) Within Treatments	36.13	9	4.014	(Error)
4) Within Platings	256.08	252	1.016	
5) Between Tests	0.438	1	0.4380	0.36
6) Between Finishes (SEP)	12.467	2	6.233	5.13**
7) Finishes (SEP) × Tests	13.885	2	6.942	5.71**
8) Finishes (SEP) × Treatment	145.37	16	9.086	7.47***
9) Sampling	83.92	162	0.5212	0.43
10) Residual	84.44	69	1.216	(Error)
Total	339.81	269		

**Significant at one per cent level.
***Significant at 0.1 per cent level.

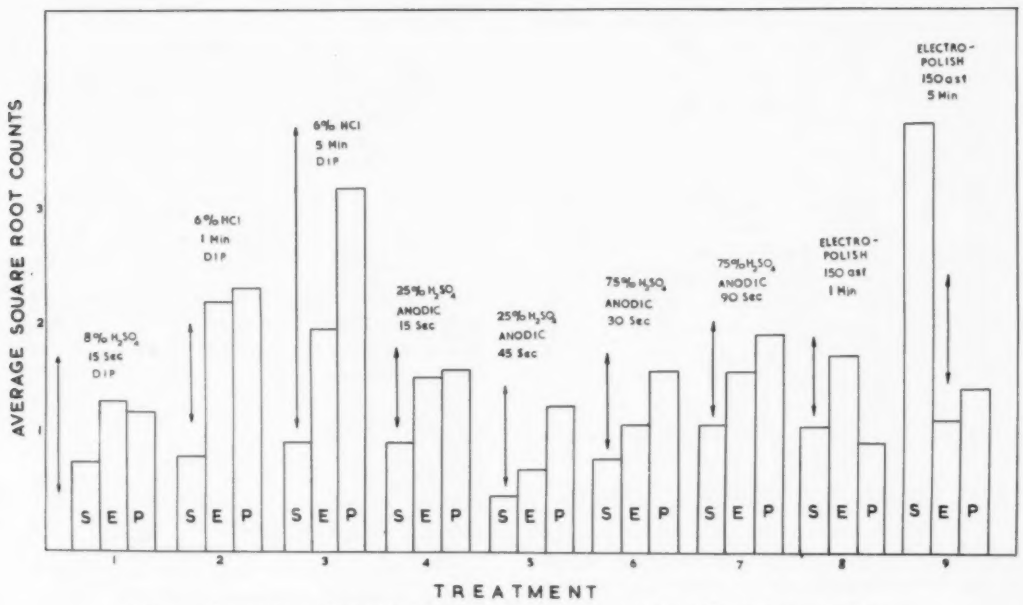
AVERAGE SQUARE ROOT COUNTS
8% H_2SO_4 15 Sec DIP
6% HCl 1 Min DIP
6% HCl 5 Min DIP
25% H_2SO_4 ANODIC 15 Sec
25% H_2SO_4 ANODIC 45 Sec
75% H_2SO_4 ANODIC 30 Sec
75% H_2SO_4 ANODIC 90 Sec
ELECTRO-POLISH 150 asf 1 Min
ELECTRO-POLISH 150 asf 5 Min
S E P
TREATMENT

Fig. 2. Comparative effect of treatment on the performance of the different surface finishes.

tion that can be obtained from the experiment, and that the pattern of corrosion behavior for the particular plating system used is established early in the test. This point may be of practical significance in performance testing of production parts if it can be demonstrated that other plating combinations behave similarly.

DIRECT COMPARISON OF HYDROCHLORIC AND SULFURIC ACID DIPS

As the general study of chemical treatments appeared to show an anomalous difference between hydrochloric and sulfuric acid dips, and these treatments are often used interchangeably in the industry, this effect was investigated in greater detail. Acids of the same normality (2N) were chosen and the experiment was designed to eliminate the ambiguity that can come from plating variability. Fortunately, with simple acid dips and identical times of immersion, it is possible to modify the experimental technique in such a way that specimens subjected to two different treatments can be plated simultaneously and comparisons made within each plating. Using the symmetrical arrangement described previously,[2] alternate specimens located on the circumference of the fixed mount were immersed simultaneously in the two acids, a separate vessel containing the particular acid being used for each specimen. Similarly, by using individual containers, the specimens were rinsed without the possibility of mutual contamination between the acids and entered the plating bath together under the required conditions. In all other phases of specimen preparation and testing the procedures used were the same as in the general study of chemical treatments, except that the specimen size was increased to 1.5 by 1.5 in.

The performance of the standard surface (S) and the commercially polished surface (P) was compared for the two acids at room temperature using immersion times of 15 seconds, 1 minute and 5 minutes. The counts of corrosion failures for exposure times of 4 and 24 hours are given in Table VII and the detailed analysis of variance of the data at the 24 hour period is recorded in Table VIII. The latter clearly shows that there is no difference in performance be-

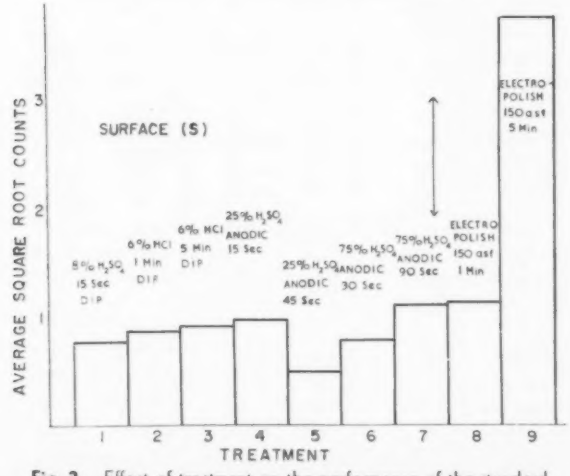
SURFACE (S)
AVERAGE SQUARE ROOT COUNTS
8% H_2SO_4 15 Sec DIP
6% HCl 1 Min DIP
6% HCl 5 Min DIP
25% H_2SO_4 ANODIC 15 Sec
25% H_2SO_4 ANODIC 45 Sec
75% H_2SO_4 ANODIC 30 Sec
75% H_2SO_4 ANODIC 90 Sec
ELECTRO POLISH 150 asf 1 Min
ELECTRO-POLISH 150 asf 5 Min
TREATMENT

Fig. 3. Effect of treatment on the performance of the standard surface (S).

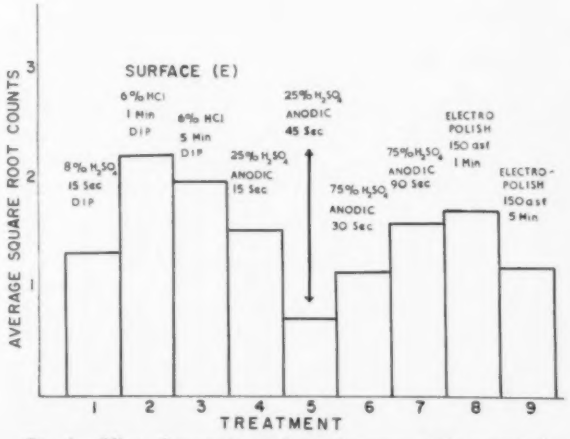
SURFACE (E)
AVERAGE SQUARE ROOT COUNTS
8% H_2SO_4 15 Sec DIP
6% HCl 1 Min DIP
6% HCl 5 Min DIP
25% H_2SO_4 ANODIC 15 Sec
25% H_2SO_4 ANODIC 45 Sec
75% H_2SO_4 ANODIC 30 Sec
75% H_2SO_4 ANODIC 90 Sec
ELECTRO POLISH 150 asf 1 Min
ELECTRO-POLISH 150 asf 5 Min
TREATMENT

Fig. 4. Effect of treatment on the performance of the extended surface (E).

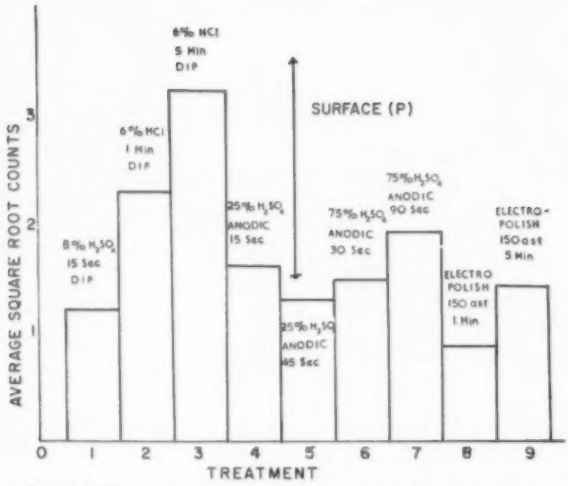
AVERAGE SQUARE ROOT COUNTS
TREATMENT
SURFACE (P)
8% H_2SO_4 15 Sec DIP
6% HCl 1 Min DIP
6% HCl 5 Min DIP
25% H_2SO_4 ANODIC 15 Sec
25% H_2SO_4 ANODIC 45 Sec
75% H_2SO_4 ANODIC 30 Sec
75% H_2SO_4 ANODIC 90 Sec
ELECTRO-POLISH 150 ast 1 Min
ELECTRO-POLISH 150 ast 5 Min

Fig. 5. Effect of treatment on the commercially polished surface (P).

tween the two acids for any of the immersion times. A pronounced difference in durability does exist between the two surface finishes and this is significant at the 0.1 per cent level. The poorer corrosion performance exhibited by the commercially polished surface is consistent for both acids at all immersion times used. This is illustrated in Fig. 6 where, again, the length of the arrow for each chemical treatment represents a difference in performance which is statistically significant at the five per cent level. The well defined difference in durability between these two surface finishes in this experiment, as compared to the results obtained in the general study of chemical treatments, is attributable to the better consistency of the corrosion data. The fact that the surface finish-immersion time interaction is at a significant level indicates that the relative difference in performance between the finishes varies with the length of dip for both acids. This can be deduced from inspection of Fig. 6 and it is apparent that there is an improvement in the durability of the commercially polished surface at the longest immersion time.

METALLOGRAPHIC STUDY OF THE STEEL-NICKEL INTERFACES

The surprising difference in the durability of the standard

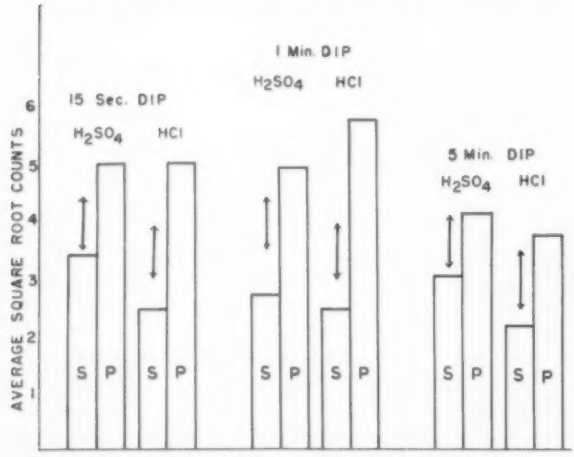

Fig. 6. Comparison of sulfuric and hydrochloric acid dips on the performance of the standard (S) and commercially polished (P) surfaces.

TABLE VI
DETAILED ANALYSIS OF VARIANCE OF CORROSION DATA FOR TREATMENTS 1-9
(24 Hours Exposure, Sq Roots of Counts)

Section I: Individual Treatments

Source of Variation	Sum of Squares of Deviations	Degrees of Freedom	Mean Squares	F
Treatment 1—8% H_2SO_4—15 Sec Dip				
Between Platings	0.0658	1	0.0658	0.08
Within Platings	22.3716	28	0.7989	
Between Finishes (SEP)	1.733	2	0.8668	0.57
Finishes × Tests	2.379	2	1.189	0.78
Tests	1.016	1	1.016	0.67
Sampling	9.621	18	0.534	0.35
Residual	7.619	5	1.523	(Error)
Total	22.437	29		
Treatment 2—6% HCl—One Min Dip				
Between Platings	4.443	1	4.444	3.30
Within Platings	37.646	28	1.345	
Between Finishes (SEP)	13.287	2	6.644	9.34**
Finishes × Tests	3.028	2	1.514	2.13
Tests	6.098	1	6.098	8.58**
Sampling†	12.801	18	0.711	(Error)
Residual	2.431	5	0.486	
Total	42.090	29		
Treatment 3—6% HCl—Five Min Dip				
Between Platings	12.949	1	12.949	5.89*
Within Platings	61.557	28	2.198	
Between Finishes (SEP)	28.269	2	14.134	3.00
Finishes × Tests	0.226	2	0.113	0.02
Tests	0.480	1	0.480	0.10
Sampling	9.003	18	0.500	0.11
Residual	23.577	5	4.715	(Error)
Total	74.506	29		
Treatment 4—25% H_2SO_4—Anodic Etch—15 Sec				
Between Platings	0.0376	1	0.0376	0.072
Within Platings	14.716	28	0.5255	
Between Finishes (SEP)	2.446	2	1.223	2.38
Finishes × Tests	0.0888	2	0.0444	0.086
Tests	2.597	1	2.597	5.04*
Sampling†	9.269	18	0.5149	(Error)
Residual	0.314	5	0.0728	
Total	14.753	29		
Treatment 5—25% H_2SO_4—Anodic Etch—45 Sec				
Between Platings	0.2440	1	0.2440	0.429
Within Platings	15.925	28	0.5687	
Between Finishes (SEP)	4.168	2	2.084	2.28
Finishes × Tests	0.4838	2	0.242	0.27
Tests	2.526	1	2.526	2.77
Sampling	4.181	18	0.232	0.25
Residual	4.566	5	0.913	(Error)
Total	16.170	29		

(Continued on the next page)

TABLE VI (Continued)

DETAILED ANALYSIS OF VARIANCE OF CORROSION DATA FOR TREATMENTS 1-9

(24 Hours Exposure, Sq Roots of Counts)

Section 1: Individual Treatments

Source of Variation	Sum of Squares of Deviations	Degrees of Freedom	Mean Squares	F
Treatment 6—75% H_2SO_4—Anodic Etch—30 Sec				
Between Platings	0.0875	1	0.0875	0.210
Within Platings	11.693	28	0.4176	
Between Finishes (SEP)	2.457	2	1.228	2.75
Finishes × Tests	0.0320	2	0.0160	0.036
Tests	0.0875	1	0.0875	0.196
Sampling†	8.0364	18	0.4464	(Error)
Residual	1.0798	5	0.2159	
Total	11.781	29		
Treatment 7—75% H_2SO_4—Anodic Etch—90 Sec				
Between Platings	7.8173	1	7.817	1.77
Within Platings	12.3731	28	0.442	
Between Finishes (SEP)	3.2198	2	1.6099	2.28
Finishes × Tests	0.3714	2	0.1857	0.26
Tests	0.4320	1	0.4320	0.61
Sampling	4.8164	18	0.2676	0.38
Residual	3.5334	5	0.7067	(Error)
Total	20.1903	29		
Treatment 8—Electropolishing—One Min				
Between Platings	8.855	1	8.855	10.62**
Within Platings	23.355	28	0.834	
Between Finishes (SEP)	3.359	2	1.679	2.46
Finishes × Tests	0.0685	2	0.0342	0.05
Tests	6.2116	1	6.211	9.10**
Sampling†	12.284	18	0.682	(Error)
Residual	1.430	5	0.286	
Total	32.211	29		
Treatment 9—Electropolishing—Five Min				
Between Platings	1.364	1	1.364	0.667
Within Platings	57.240	28	2.044	
Between Finishes (SEP)	40.195	2	20.079	22.28**
Finishes × Tests	0.171	2	0.0859	0.095
Tests	0.0123	1	0.0123	0.014
Sampling	12.349	18	0.6861	0.76
Residual	4.510	5	0.9021	(Error)
Total	58.604	29		

Section 2: Surface Finish

(S) Standard Surface				
Between Platings	87.439	17	5.143	
Between Treatments	76.249	8	9.531	7.67**
Within Treatments	11.189	9	1.243	
Within Platings	41.741	72	0.441	
Total	129.181	89		

†Sampling used as error when it is greater than residual.

(*Continued in the next column*)

surface on increasing the electropolishing time and the absence of a similar effect for the extended and commercially polished surfaces prompted further investigation. Consequently a careful metallographic study was made of the effect of the various chemical treatments on the nature of the basis metal surface using the taper sectioning technique. The more important changes in surface condition resulting from the different treatments are illustrated by the three pairs of photomicrographs shown in Figs. 7, 8 and 9.

Figure 7 provides a comparison of the appearance of the standard surface after electropolishing for one and five minutes. As can be seen, the five minute electropolish gives a very smooth contour at the plating interface with evidence of discontinuity at the grain boundaries, while the one minute treatment leaves traces of the original surface finish with remnants of distorted metal crystals. Together with the corrosion results this would indicate that a smooth distortion free surface can be more detrimental for good corrosion performance than a mechanically polished surface of reasonable roughness. A plausible explanation of this phenomenon lies in the fact that, with a surface free of distortion, nucleation will occur preferentially at the grain boundaries. With such a condition, propagation of crystal imperfections through the deposit to the surface would be expected to occur easily from these locations, particularly with the coarse acicular type structure obtained from the Watts bath. It can be assumed that these crystal defects would provide well defined anodic sites on the surface of the deposit for the initiation of pitting attack. With a mechanically polished surface, where there are many points of high surface energy due to crystal distortion, etc., nucleation sites are likely to be more numerous and more evenly distributed leading to anodic centers which are less well defined in relation to the general surface potential.

A logical reason why this effect of prolonged electropolishing is not observed with the stretched or commercially polished surfaces is surface roughness. The surface contour of the commercially polished specimens after one and five minutes electropolishing (Fig. 8) shows that the longer electropolishing time removes most of the initial, highly stressed regions resulting from mechanical working of the surface, but does not produce the same flat contour observed with the

TABLE VI (Continued)

Section 2: Surface Finish

Source of Variation	Sum of Squares of Deviations	Degrees of Freedom	Mean Squares	F
(E) Extended Surface				
Between Platings	32.656	17	1.921	
Between Treatments	16.210	8	2.026	1.11
Within Treatments	16.445	9	1.827	
Within Platings	38.600	72	0.536	
Total	71.257	89		
(P) Commercial Polished Surface				
Between Platings	77.923	17	4.584	
Between Treatments	40.740	8	5.093	1.23
Within Treatments	37.182	9	4.131	
Within Platings	49.044	72	0.681	
Total	126.967	89		

*Significant at five per cent level.
**Significant at one per cent level.
***Significant at 0.1 per cent level.

laboratory polished specimens. Thus the condition of well defined grain boundaries is not achieved with this type of surface. The work of Samuels[6, 7] suggests an alternative explanation. He has shown that metal deformation due to mechanical polishing can extend for a considerable depth below the surface. If this deformed layer is not removed completely by electropolishing, the residual crystal misorientations may prevent oriented overgrowth which provides the opportunity for grain boundary and other imperfections to be continued through the deposit.

It is also of interest to compare the surface condition of the stretched or commercially polished specimens after a simple acid dip and anodic etching since the latter show a trend towards better durability although, in most cases, the differences are within the confidence level adopted for the experiment. An illustration of this is shown in Fig. 9, which contains photomicrographs of the commercial surface after a five minute hydrochloric acid dip and a 45 second anodic etch in 25 per cent sulfuric acid (treatments 3 and 5). As expected, the higher stock removal of the anodic treatment

TABLE VII
CORROSION DATA FOR COMPARISON OF ACID DIPS
(No. of Failures per Specimen)

Four Hours Exposure

Dip	Time	Polishing	I		II		III		IV		Total
2N H_2SO_4 (8.9% w/w)	15 sec	Standard (S)	14	9	6	5	8	8	3	6	59
		Commercial (P)	32	54	34	10	20	6	19	15	190
2N HCl (6.8% w/w)	15 sec	Standard (S)	10	6	9	3	4	7	4	4	47
		Commercial (P)	40	42	26	19	11	15	36	9	198
			VI		VII		IX		XII		
2N H_2SO_4 (8.9% w/w)	1 min	Standard (S)	11	5	2	1	4	3	12	21	59
		Commercial (P)	20	24	28	22	12	16	33	33	188
2N HCl (6.8% w/w)	1 min	Standard (S)	2	6	1	3	8	3	13	5	41
		Commercial (P)	17	23	25	27	24	39	43	48	246
			V		VIII		X		XI		
2N H_2SO_4 (8.9% w/w)	5 min	Standard (S)	7	9	7	2	45	4	5	6	85
		Commercial (P)	12	13	11	10	13	11	29	27	126
2N HCl (6.8% w/w)	5 min	Standard (S)	4	7	2	1	5	4	5	9	37
		Commercial (P)	11	11	12	12	11	16	15	16	104

24 Hours Exposure

Dip	Time	Polishing	I		II		III		IV		Total
2N H_2SO_4 (8.9% w/w)	15 sec	Standard (S)	17	10	9	5	9	8	3	7	68
		Commercial (P)	37	61	36	13	21	6	24	19	217
2N HCl (6.8% w/w)	15 sec	Standard (S)	11	6	9	3	5	7	4	5	50
		Commercial (P)	47	42	27	19	11	17	41	10	214
			VI		VII		IX		XII		
2N H_2SO_4 (8.9% w/w)	1 min	Standard (S)	12	5	5	2	5	3	13	22	67
		Commercial (P)	20	25	29	26	12	18	45	36	211
2N HCl (6.8% w/w)	1 min	Standard (S)	2	6	6	3	12	4	15	5	53
		Commercial (P)	21	26	25	27	26	39	59	52	275
			V		VIII		X		XI		
2N H_2SO_4 (8.9% w/w)	5 min	Standard (S)	7	9	10	2	46	4	8	7	93
		Commercial (P)	16	14	12	10	17	11	29	32	141
2N HCl (6.8% w/w)	5 min	Standard (S)	4	7	2	2	5	4	5	10	39
		Commercial (P)	13	11	12	12	11	19	16	20	114

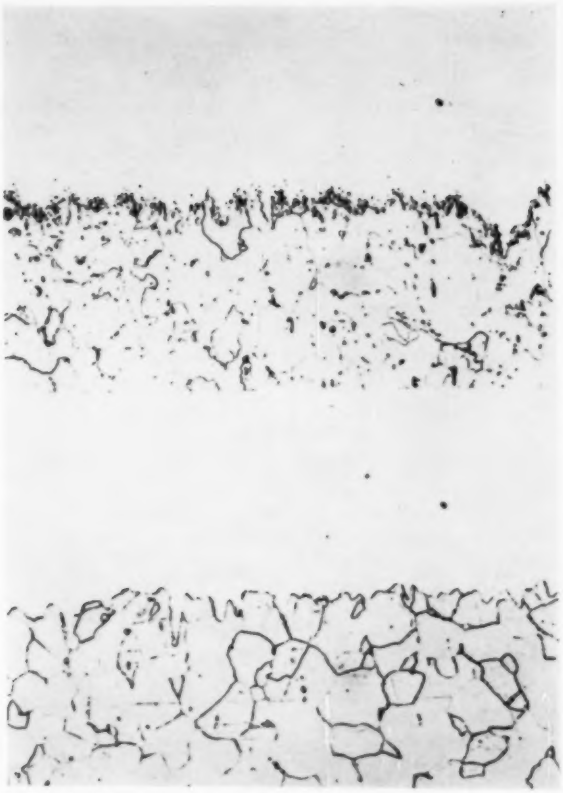

Fig. 7. Taper section of standard surface after one minute (upper) and five minutes electropolish. Original magnification 250X, taper ratio 8:1.

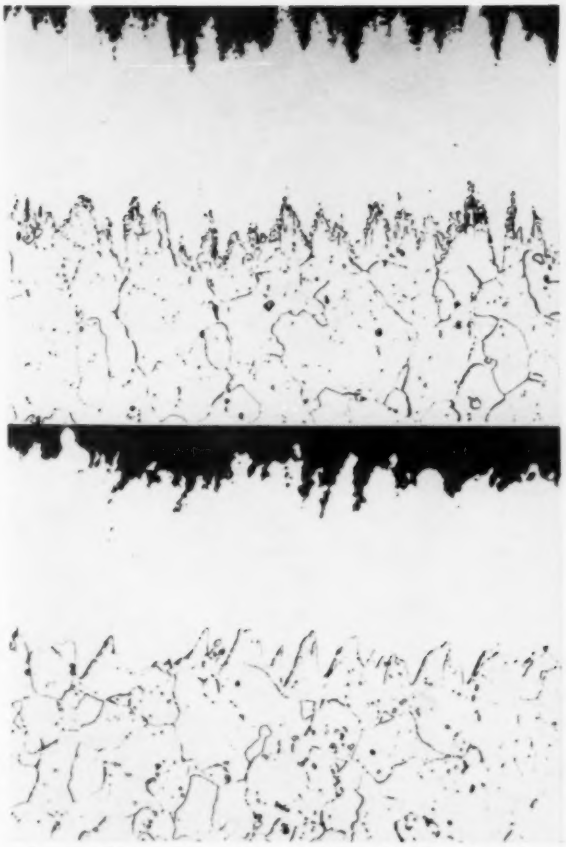

Fig. 8. Taper section of commercially polished surface after one minute (upper) and five minutes electropolish. Original magnification 250X, taper ratio 8:1.

results in a smoother surface contour and a reduction in the stressed areas at the interface. This treatment should also eliminate fragmentary metal.[5]

CONCLUSIONS

The purpose of this investigation was to determine whether basis metal conditions known to be detrimental to the corrosion performance of nickel deposits can be controlled by the choice of suitable chemical treatments prior to plating. It has been demonstrated that certain treatments, particularly anodic etching and electropolishing, can modify the surface condition of a steel base in a manner that influences dura-

TABLE VIII

ANALYSIS OF VARIANCE ON CORROSION DATA FOR ACID DIPS

(24 Hours Exposure, Square Roots of Counts)

Source of Variation	Sum of Squares of Deviations	Degrees of Freedom	Mean Squares	F
Between Platings	49.31	11	4.48	2.03*
Within Platings	185.97	84	2.21	
Between Immersion Times	9.20	2	4.60	
Within Immersion Times	40.10	9	4.45	
Between Acids	0.935	1	0.935	1.22
Between Finishes	112.36	1	112.36	146.65***
Finishes × Acids	2.495	1	2.495	3.26
Acids × Times	3.049	2	1.524	1.99
Finishes × Times	9.340	2	4.670	6.10**
Acids × Finishes × Times	0.338	2	0.169	0.22
Duplicates	36.76	48	0.766	1.00
Residual	20.68	27	0.766	(Error)
Total	235.28	95		

*Significant at five per cent level.
**Significant at one per cent level.
***Significant at 0.1 per cent level.

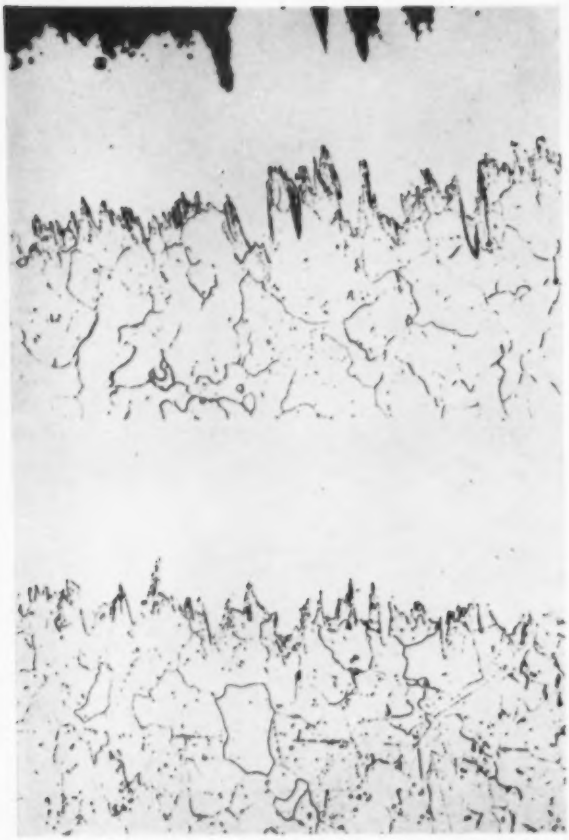

Fig. 9. Taper section of commercially polished surface after five minutes hydrochloric acid dip (upper) and 45 seconds anodic etch in 25 per cent sulfuric acid (lower). Original magnification 250X, taper ratio 8:1.

bility. However, the effect is of limited scope and is dependent on both the nature of the surface finish and the treatment.

With a well prepared surface, such as that obtained with laboratory polishing by hand, no difference in corrosion performance could be detected between simple acid dips which have a minimum effect on the surface and anodic etches which involve appreciable stock removal. Thus there appears to be a level of surface finish at which optimum durability is obtained and this is not improved by more severe chemical treatments. In fact it has been established that, with such a surface, prolonged electropolishing can result in a surface condition which is highly detrimental to the corrosion performance of a deposit.

With surface finishes giving relatively poor corrosion resistance, of which the stretched and commercially polished surfaces were chosen as examples, there is a trend for anodic etches and electropolishing to give better performance than conventional acid dips. However, within the reproducibility of the corrosion data which was poorer than in previous experiments because of the difficulty of eliminating plating variability from the effect of treatment, the differences in durability were largely within the confidence level (five per cent) chosen for the experiment. For the same reason, a clear distinction between the relative merits of the various electrochemical treatments could not be made, although it is noted that the best performance was obtained with the 45 second anodic etch in 25 per cent sulfuric acid (treatment 5).

It has been shown that there is no difference between dilute hydrochloric and sulfuric acid dips of the same duration, although there is a trend for increased immersion times to give better durability with a poor surface finish.

ACKNOWLEDGMENTS

The authors are indebted to Dr. D. B. DeLury and Dr. G. F. Watson, Department of Mathematical Statistics, Ontario Research Foundation, for their able assistance in the design of the statistical experiments and in the analysis and interpretation of the data.

Acknowledgment is also due to the Research Committee: J. D. Thomas, General Motors Corporation, chairman; Dr. D. G. Foulke, Sel-Rex Corporation, vice chairman; and C. F. Nixon, General Motors Corporation, district supervisor; and the Project Committee: W. M. Tucker, chairman; A. J. Adams, Armalite Company; E. P. Blandy, Canadian Arsenals Limited; C. H. Hubbleday; Dr. J. V. Petrocelli, International Nickel Company; W. L. Pinner, McGean Chemical Company; H. A. Skelton, International Nickel Company; B. C. Teal, Dr. L. Weisberg and Kergan Wells, W. W. Wells Limited; for their interest and many contributions to the work.

This investigation forms part of the Group Research Project sponsored jointly by the American Electroplaters' Society and the Province of Ontario through its Department of Planning and Development.

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Dr. Maurice H. Jones is a graduate of The University of London, England, where he obtained a BSc degree in chemistry in 1947 and a PhD degree in 1950. He spent two years as a postdoctorate research fellow at the National Research Council, Ottawa, and returned to England in 1952 on an appointment as research associate at The University of Birmingham. In 1954 he joined the staff of the Ontario Research Foundation as an assistant director in the Department of Chemistry and for the past six years has directed the Canadian AES Research Project. His main research interests are in the field of physical chemistry, including electroplating, corrosion and polymerization.

Dr. Jones is a member of the AES, the Faraday Society, the Institute of Metal Finishing and the Canadian Institute of Chemistry.

Joseph Saiddington received his MASc degree in 1956, from the University of Toronto, where he was actively engaged for a period of two years on chemical plant design problems. He studied in London, England, where he graduated as a chemical engineer, and has served as the research associate of AES Research Project No. 14 since 1955. He is a member of the AES, Toronto Branch.

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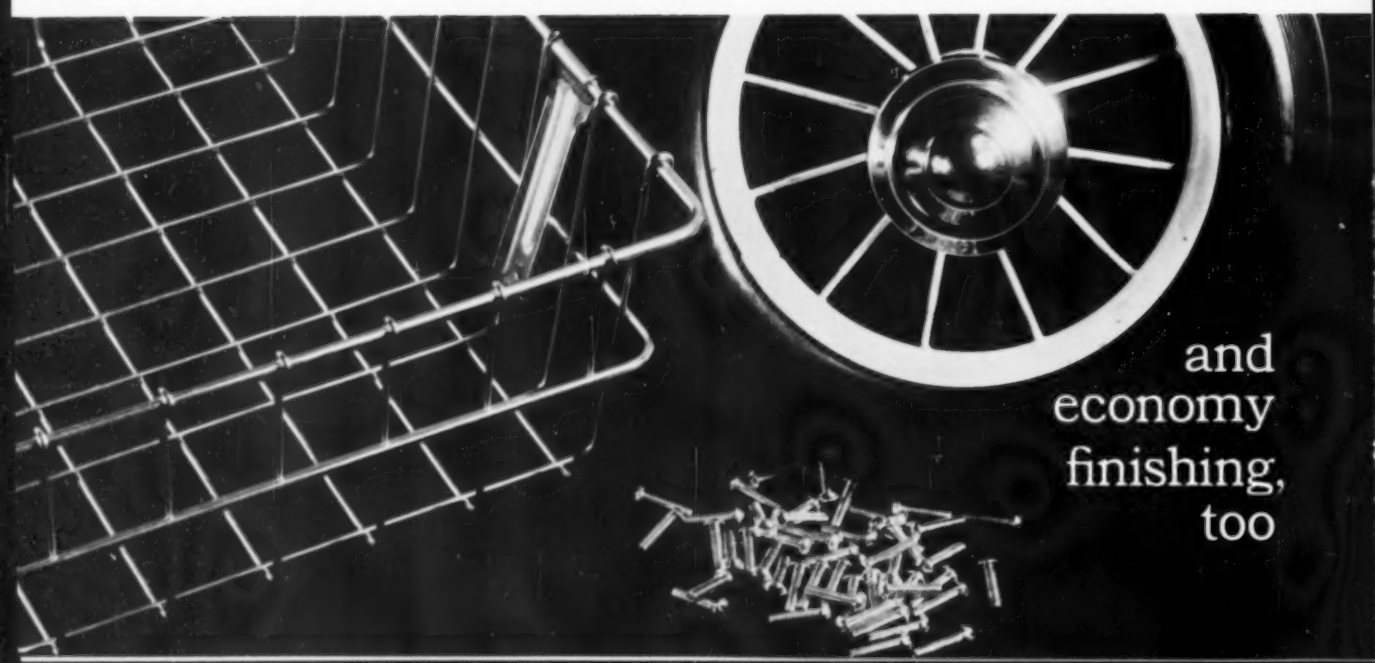

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PRESIDENT'S REPORT

AMERICAN ELECTROPLATERS' SOCIETY, INC.

By

DR. W. ANDREW WESLEY

THE vigor with which the AES pursues its objectives and the large number of dedicated people who serve the Society unselfishly on its many Branch and National Committees seem miraculous when it is considered that the AES is almost unique among non-profit technical and educational societies in the heterogeneity of its membership. Of some 200 such societies in the United States there are probably not more than three or four which have membership groups so widely different in education, training and salary as are incorporated in the AES. The common bonds uniting the AES members are a desire to advance the knowledge of the arts and science of metal finishing, respect of each group for the peculiar abilities and experience of the others, together with a long and happy history of good fellowship and mutual assistance.

THE HEALTH OF THE SOCIETY

The health of the Society is shown by the birth of new Branches each year as metal finishing shops spring up in new industries in previously non-manufacturing areas of the country. As soon as there are a dozen metal finishing departments or shops in any area at a distance from an existing AES Branch, the operators feel impelled to band together. Are their needs satisfied by simply forming a local organization to meet local problems? Not at all. They feel a strong urge to become part of the world of metal finishing, to know what is going on everywhere and to meet the people who are promoting the progress of the industry. So they apply for a charter and start another Branch of the international society that is the AES.

The AES is starting its fifty-third year of service. There is no reason to doubt today that some of its present members will take part in celebrating the start of its second century in 2009. This long view marked the spirit in which the Supreme Society met at Hartford for its Interim Meeting. The financial structure was reviewed against the background of the changing times. Long range action to adjust budgets and sources of income was thoroughly discussed with the aim of guaranteeing uninterrupted progress during the coming years. While, of course, no legal action could be taken at Hartford, a groundwork of better understanding of the problems was laid to permit well-advised action at Boston in June and in subsequent Annual Meetings.

Dr. W. Andrew Wesley

IMPROVEMENT OF FINISHING OPERATIONS

The members can be proud of the researches sponsored by the AES and administered through its Research Committee. The projects continue to be operated effectively at a cost which is much lower per investigator than that paid by industrial firms for similar work. The services of the experts who are members of the various Project Committees are obtained without charge to AES. Without this fortunate arrangement, the Research Program would be necessarily of minor size and value.

On the unsatisfactory side of the ledger is the need for

* AES's fiscal year, as altered by the Supreme Society effective in 1958, now spans from July 1 through June 30 instead of April 1–March 30 as before. So as to publish this Annual Report for the current fiscal year (July 1, 1960 through June 30, 1961) for issuance to Delegates in advance of the Annual Meeting of the Supreme Society, and so as to publish it in the Convention issue of PLATING MAGAZINE (June 1961), it manifestly can cover only the nine-month period ending March 31, 1961, as last year. A complete certified financial statement for the full fiscal year will be published as promptly as possible after audit and certification by Clyde A. Zukswert & Co., Newark, N. J., certified public accountants.

THE SOCIETY'S 1960-1961 EXECUTIVE BOARD AND NATIONAL OFFICERS

Left to right, Manuel Ben, Second Vice President; Chester G. Borlet, First Vice President; Dr. W. Andrew Wesley, President; John P. Nichols, National Executive Secretary; Frank O. Beuckman, Third Vice President; Ralph D. Wysong, Past President.

bridging the gap between the research investigator and the man in the shop. More effort must be exerted in the future to present the research results not only in scientific but also in shop terms.

DISSEMINATION OF KNOWLEDGE

The AES aids in broadcasting available knowledge in its fields of interest through Branch educational programs and plating courses; Regional conferences; an Annual Convention with the resultant bound volume of Technical Proceedings and, finally, through PLATING MAGAZINE. The latter brings to each member a large number of technical articles and information services with new features added each year. Some members do not realize the other important function performed by PLATING in its capacity as the official journal of the AES. It is a tie that binds the far-flung Branches into one cooperative body. Without its reporting of news, advance programs and Society activities, the AES would disintegrate into local groups incapable of joint action and without influence in promoting the advancement of the art of metal finishing.

COMMITTEES

The manifold activities of the AES other than those carried on at National Headquarters are handled by a large number of committees. It is a matter of concern that the hard-working members of these committees get very little recognition and, in many instances, no thanks for their unpaid efforts. The important work of the Research Committee has been mentioned and is also reported elsewhere by its Chairman. But what about the Editorial Board, the Educational, Law, Membership, Honorary Membership, Paper Awards, Public Relations, Proctor Award and Scientific Achievement Award Committees, not to mention all the AES liaison representatives with other Societies? The Publications Committee deserves special commendation for organizing symposia which will result in publication of several books by the AES. These will make available knowledge of hydrogen embrittlement of plated metals and of the plating of aluminum and uncommon metals. Note that this will be done at no net cost to the AES.

IN CONCLUSION

Your President wishes to close this report with comment on the "state of the Society." The condition of the AES as an active operating organization is sound. In spite of an economic recession, the Society is in good financial condition. There are, however, two principal problems for the statesmen of the AES to solve. The solution to these must be sought soberly and with adequate study. There is time enough to do this carefully. A start has been made on both counts by the present Executive Board. These problems are: (1) balancing the cost of operations with Society income so that there will be no further drain on capital assets; and (2) reorganizing the structure of the Society to reduce the size of the governing body, modernize the administrative set-up to speed up needed action, institute a better system for nominating and electing officers, shorten their tour of duty, and institute changes which will enable the Society to assist weak Branches.

The list of Delegates and the roster of AES Past Presidents contain the names of many men of statesmanlike stature. With their support an adequate solution of these problems will be found by the Executive Board.

♦

FIRST VICE PRESIDENT'S REPORT

by

CHESTER G. BORLET

Chester G. Borlet

PRUDENTLY, AES Law requires the First Vice President to serve as a member of the Educational Committee. As my first line of duty, I am happy to report the affairs of that Committee for the fiscal year.

Your Educational Committee currently has seven projects on its agenda. Each project is under the direction of a Sub-Committee Chairman. Two projects have been completed while the other five are progressing.

BYLAWS

The Bylaws of the Committee were amended so that there is at present no conflict with the Society's own Constitution and Bylaws. This action was certified by the Law Committee and approved by your Executive Board.

BRANCH SPEAKERS MANUAL

Under the able direction of Rafael Diaz, the momentous task of compiling information for our annual Speakers List was completed. Mr. Diaz has handled this work practically since its inception. The 1960-1961 edition makes the third publication of this valuable reference document prepared almost single-handedly by him. Reports continue to reach the Executive Board lauding the merits of the Speakers List. Further, my visits to Branch and Regional meetings, clearly indicate that this fine piece of work is being consulted for Branch educational and program planning.

ELECTROPLATING COURSES

"One of the prime reasons why the AES has continued to grow is its concern with the education of its members. Not only were papers on electroplating and allied arts read at Branch and Society meetings, but from the beginning, the Branches set up schools for platers where they could learn the fundamentals of their calling," said K. G. Soderberg in his article "AES And How It Began" that appeared in PLATING MAGAZINE, October 1948.

So that we may all get a clear picture of how plating courses have fared over the years and why your Educational Committee is so keenly concerned in developing further interest, here are some pertinent data. In 1913, there were 11 Branches sponsoring 5 electroplating classes. In 1930-32, of some 27 Branches, 14 had classes operating. In 1955, there were 55 Branches in our Society, and 11 courses were then being taught.

To augment this information, this year Sub-Committee Chairman Nelson F. Murphy surveyed all Branches to learn if they sponsored electroplating courses. Reporting Branches responded as follows:

Branches answering questionnaire	34
Branches sponsoring courses	8
Branches not sponsoring course but course available in nearby school	3
Branches sponsoring no course	23

As a result this survey has very forcibly brought home the fact that an area of challenge to the Educational Committee is the large number of Branches who sponsor no electroplating courses. Your Educational Committee

has realized for some time that Branches may need help in planning courses, and had been working along the lines of actually preparing courses of a varying degree of advancement. It was felt a better approach would be to organize an electroplating course by breaking it down into the various phases of electroplating, as for instance, general plating chemistry; cleaning; copper plating; rack coating and stop off materials, etc. A packet containing an outline for each phase of the course could then be supplied the Branch wishing to sponsor a course. It would then be the Branch Educational Committee's responsibility to obtain qualified personnel to teach each phase.

To further stimulate a greater number of student participation in Branch electroplating courses, a uniform certificate of completion was contemplated. The format and design of this diploma has been completed but methods of issuance are still under advisement at Educational Committee level.

CORRESPONDENCE COURSES

It had been proposed that the Educational Committee consider preparing a correspondence course in electroplating for Executive Board publishing consideration. This proposal was circularized throughout the Educational Committee prior to its Hartford meeting on February 11, 1961. It was then thoroughly discussed at this meeting. It was the consensus of the group that the matter of creating such a correspondence course is far beyond the scope of the Educational Committee. The proposal was consequently abandoned. The Committee will still continue, however, to study the subject.

CONCLUSION

Your First Vice President was honored to have taken part in a number of Branch and Regional educational programs. The privilege of actual participation in AES educational programs and attending many educational meetings gives one an insight into the care that respective Branches and Regions employ in planning such programs. One cannot help getting the feeling that your Society is zealously striving to foster those purposes set up as the objectives of your Educational Committee.

Finally, representing AES as its First Vice President, I attended all Executive Board meetings. It is my wish to inform you that all matters of the Society are handled by a group of men who, before making a decision, amicably discuss problems from all angles, and are then unanimous in final resolutions. I state without reservation that it has been a distinct privilege to have been associated with the members of the present Executive Board.

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SECOND VICE PRESIDENT'S REPORT

by

MANUEL BEN

IN 1957, the Supreme Society recognized that the Second Vice President could not adequately promote membership growth throughout the Society during his term of office. The only part of the program carried over from year to year was the application blank and initiation fee. The Supreme Society at the Montreal Convention of 1957 approved an amendment to the Bylaws, setting up a nine-man Membership Committee which would perpetuate itself in the same manner as the United States Congress. This wise action has provided a planned long-range membership promotion.

NATIONAL MEMBERSHIP COMMITTEE

The Membership Committee at its Los Angeles meeting in July 1960 selected John J. Bunsic of the Southern Tier Branch as its Chairman. For the purpose of stimulating membership at the Branch level, each AES Branch was geographically classified and the Membership Committee members were assigned as Regional Chairmen to assist the Branch First Vice Presidents in fulfilling their membership promotion responsibilities.

Manuel Ben

In September 1960, the membership campaign was started at Committee level. With the cooperation of National Headquarters and PLATING MAGAZINE, the mem-

SECOND ANNUAL MIDWEST REGIONAL CONFERENCE IN SOUTH BEND, OCTOBER 1960

(1) Chester G. Borlet, standing, left, moderator, and panel members of the Mechanical Finishing workshop. (2) Ralph D. Wysong, standing, moderator, and panel members of the Organic Finishing workshop. (3) Manuel Ben, standing, moderator, and panel members of the Plating workshop. (4) Midwest Council meets to plan for 1961 regional conference. *Photo Courtesy of Products Finishing Magazine*

MEMBERSHIP CENSUS AS OF APRIL 1, 1961

BRANCH	CORRECTED BRANCH MEMBERS JULY 1, 1960	ELECTED	REINSTATED	IN TRANSFER	OUT TRANSFER	RESIGNATIONS	SUSPENSIONS	DEATHS	BRANCH MEMBERS APRIL 1, 1961	SUSTAINING MEMBERSHIPS
Adelaide	34	2	—	—	—	—	1	—	35	—
Allentown-Reading	47	5	1	—	—	3	1	—	49	4
Baltimore-Washington	110	—	1	—	1	—	11	—	99	3
Blue Ridge	41	30	—	2	1	—	2	—	70	1
Boston	149	22	3	—	—	—	3	—	171	4
Bridgeport	149	2	—	1	1	2	1	1	147	6
British Columbia	42	3	3	1	—	2	6	—	41	—
Buffalo	108	4	3	—	—	6	13	1	95	1
Capitol District	33	—	1	—	—	—	1	—	33	1
Central Michigan	53	3	—	—	—	—	2	—	54	—
Chicago	420	22	2	1	2	—	30	—	413	59
Cincinnati	102	11	—	—	2	1	2	—	108	1
Cleveland	241	14	8	2	1	2	33	1	228	19
Columbus	78	5	—	—	—	3	6	—	74	—
Dallas-Fort Worth	71	9	2	1	—	1	2	—	80	1
Dayton	104	3	1	1	2	1	1	—	105	4
Denver	46	5	—	—	—	1	3	1	46	—
Detroit	657	41	31	2	5	22	72	1	631	58
Grand Rapids	171	7	1	2	4	—	12	1	164	18
Hamilton	48	1	—	—	—	3	7	—	39	1
Hartford	168	18	15	—	2	1	28	1	169	5
Houston	32	4	2	—	—	—	4	1	33	1
Indianapolis	146	5	4	—	—	—	18	1	136	4
Kansas City	58	8	—	—	1	—	3	—	62	2
Lancaster	58	9	—	—	—	3	4	—	60	—
Los Angeles	340	26	—	3	3	—	9	1	356	19
Louisville	47	1	—	—	1	3	—	—	44	—
Melbourne	165	—	—	—	—	—	21	—	144	—
Memphis-Midsouth (A)	18	8	—	3	—	3	—	—	26	—
Miami	47	9	9	1	—	—	25	—	41	—
Milwaukee	200	10	9	1	6	1	22	—	191	10
Mississippi Valley	47	2	1	—	—	—	9	—	41	—
Mohawk Valley	43	3	2	—	1	3	1	1	42	—
Montreal	109	10	—	—	—	1	—	—	118	2
Newark	362	15	11	3	—	3	23	—	365	13
New Haven	99	1	—	—	1	2	15	1	81	5
New York	358	6	6	—	3	1	37	—	327	12
Philadelphia	240	7	7	—	—	1	22	3	228	10
Phoenix	41	6	—	1	1	—	5	1	41	—
Pittsburgh	115	13	1	1	2	3	6	—	117	4
Portland	28	9	—	—	—	—	7	—	30	—
Providence-Attleboro	95	6	—	—	—	—	1	—	100	2
Rochester	91	9	—	—	—	3	3	1	91	4
Rockford	84	5	—	—	—	1	—	—	88	2
Saginaw Valley	114	1	—	6	1	1	9	—	110	1
St. Joseph Valley	110	—	2	—	—	3	13	—	96	8
St. Louis	113	12	—	—	1	1	1	—	122	10
San Francisco	87	24	3	2	1	—	2	—	113	2
San Diego (B)	—	10	—	3	—	—	—	—	25	—
Seattle-Puget Sound	36	2	1	—	2	—	5	—	32	1
Southeastern	103	1	—	1	—	—	12	—	93	1
Southern Tier	47	1	—	—	—	—	5	—	43	1
Springfield	70	6	1	—	—	3	—	1	73	2
Sydney	92	16	—	—	—	—	—	—	108	—
Syracuse	75	—	—	2	1	1	5	—	70	1
Toledo	47	3	—	—	1	—	5	1	43	2
Toronto	187	11	8	—	—	8	18	2	178	14
Waterbury	136	8	—	1	—	3	3	—	139	15
Western Ontario	29	1	—	2	—	—	—	—	32	3
Wichita	29	1	1	—	—	—	4	—	27	1
Subtotal	6970	478	140	45	49	102	554	21	6917 (C)	
Members-at-Large	243	12	10	2	5	2	36	—	224 (C)	
Grand Total	7213	490	150	47	54	104	590	21	7141 (C)	338

Notes:

(A) Permanently chartered July 24, 1960.

(B) Temporary charter November 1, 1960; Permanent charter April 1, 1961.

(C) In addition, the Society's membership included 339 Sustaining Memberships (including one foreign) at April 1, 1961 for an aggregate Society Membership, in all membership classifications, of 7480 AES members on April 1, 1961, compared with 7563 on July 1, 1960, or a net loss of 83 members or approximately 1 per cent. (See Executive Secretary's Report.)

bership promotion was activated on a Branch level with featured stories in the October 1960 and February 1961 issues of PLATING. Some of the Regional Chairmen were invited by Branches in their area for guidance in obtaining new members and retaining present members. It is too early to assess the merits of the Regional and Branch structure for Membership Promotion. However, early reports have indicated that it is a worthwhile and needed activity.

BRANCH GROWTH

National President Wesley and National Executive Secretary Nichols presented the Memphis-Midsouth Branch, the Society's 59th Branch, its permanent charter on October 21, 1960. The San Diego Branch was granted its permanent charter on April 1, 1961, thus becoming the 60th Branch, a milestone in AES history of accomplishment. It is expected that applications for a temporary charter will arrive from a proposed 1) Central Iowa Branch, 2) Palo Alto (California) Branch, and 3) Eastern Nebraska and Western Iowa Branch. Correspondence, moreover, has been received from a new group in Mexico expressing interest in the possibility of forming a Branch in Mexico. An invitation was extended to the sponsors of the proposed Mexican Branch to meet with the Executive Board during the Boston Convention.

BRANCH MEMBERSHIP

Thanks to the efforts of many Branch officers and members, the Branch membership decline for the nine-month fiscal period to April 1, 1961 has been minimized to 53 as compared to 175 for the same period last year. It may very well be that the loss of 53 members will be eradicated when the final returns are in at the fiscal year-end.

In reviewing the April 1, 1961 membership census critically, I noted some of the bigger Branches have suffered large membership losses. Class A Branches (126 or more members) showed a decline of 137 members—five of the ten Branches accounted for a loss of 103 members. Class B Branches (70 to 125 members), 69 members—this loss was spread over 8 Branches. Class C Branches (less than 69 members), 60 members—this loss was spread over 11 Branches. The leaders in membership gain include as of April 1, 1961, Boston (Class A), San Francisco (Class B), and Blue Ridge and San Diego for Class C.

SUSTAINING MEMBERSHIP

Due to the business climate, the Sustaining Membership was reduced to 339 memberships as compared to 350 as of July 1, 1960. The Research Finance Committee is to be commended for their untiring efforts in minimizing loss.

IN CONCLUSION

The editorials in PLATING this year and the previous Annual Reports have stressed the importance of screening potential members and of membership growth to the AES. I strongly urge the participation of each member in promoting the AES membership.

It has been a privilege and a pleasure to serve you, the members, as Second Vice President. I wish to acknowledge the generosity and understanding of the General Motors Research Laboratories management for permitting me to attend Executive Board Meetings, Annual Educational Branch Meetings, and Monthly Branch Meetings.

♦

THIRD VICE PRESIDENT'S REPORT

by

FRANK O. BEUCKMAN

MY FIRST year on the Executive Board has been interesting, informative and very pleasant. As Third Vice President, it has been my task to prepare the proposed Constitution and Bylaw changes for consideration and publication. These changes have been deemed advisable by your Executive Board, and will be presented at the Annual Meeting in Boston for action by our Supreme Society. Following is a brief resume of these changes:

It is quite evident that the term "Librarian" no longer properly identifies the Branch members who so ably prepare the educational programs of our Branches throughout the year. We feel that the name "Branch Educational Chairman" more correctly identifies the duties and stature of this very important post.

The present Per Capita Tax schedule does not adequately reimburse the Society for new members elected during the fiscal year. Currently, if a member is elected during the year, the Branch is absolved from payment of a Per Capita during the entire quarter elected. A Bylaw amendment is being offered by the Executive Board to correct this inequity.

In Memoriam

ASIDE from its Founding Fathers and the multitude of members who died since its creation over a half-century ago, American Electroplaters' Society, in this its fifty-second year, also mourns the loss of the following members who passed away during 1960-1961. Their devotion to the Society and their contributions to its progress will long honor their memory.

MEMBERS

BRIDGEPORT:
J. DelVecchio

BRITISH COLUMBIA:
T. Wallington

BUFFALO:
R. Potter

CLEVELAND:
W. D. Scott

DALLAS-FT. WORTH:
A. C. Fricke
R. H. Thomas

DENVER
H. A. Schoonover

DETROIT:
J. W. Bastuba

GRAND RAPIDS:
C. M. Fermekes
J. C. Miller

HARTFORD:
W. Blankenberg

HOUSTON:
M. A. Parr

INDIANAPOLIS:
T. O. Evans

LOS ANGELES:
K. L. Thompson

MOHAWK VALLEY:
W. L. Sackett

MONTREAL:
John J. Rennie

NEW HAVEN:
Dr. R. Springer

NEW YORK:
N. A. Myers
S. L. Siegel

PHILADELPHIA:
B. Barnes
E. R. Love
O. W. Mott

PHOENIX:
Dr. Clyde A. Crowley

ROCHESTER:
F. H. Kolb

SPRINGFIELD:
A. S. Horta

TOLEDO:
F. D. Rogers

TORONTO:
L. R. Pyle
E. S. Wilson

Your Executive Board, with the cooperation of your Executive Secretary, is carefully going over every item of income and expense with the firm purpose of preparing an even tighter budget for the coming year that, while meeting the approval of our Supreme Society, will nevertheless allow us to continue to provide the services specified by the AES Constitution and Bylaws while operating our Society's business properly. We are further seeking every avenue which offers means for increasing our income. Despite these steps, however, it will evidently still be necessary to ask the Supreme Society to increase Per Capita Taxes sufficiently so as to cover the expense of our Society without the necessity of further foreseeable subsidy from our General Fund.

It has been indeed a pleasure visiting with many of the Branches in the past year. Unfortunately time did not permit me to visit all of you. However, in the coming year, I hope to get the opportunity of visiting many more Branches in our steadily progressing Society.

♦

PAST PRESIDENT'S REPORT

by

RALPH D. WYSONG

Ralph D. Wysong

WE ARE about to close the book on five wonderful years of pleasant service as a member of the American Electroplaters' Society's Executive Board. We have watched the Society grow in size as well as stature and take its rightfully earned place among the leading societies of the world. PLATING MAGAZINE has also come to be listed as the leading magazine in its class by ABC ratings.

While these five years have been pleasant, the demands on the time of those who serve on the Executive Board are very great. Those who serve conscientiously must dedicate almost all of their spare time and no little amount of their employers' time as well. Society work becomes the one and only avocation, and during the fourth year, as President, becomes a second vocation.

WHAT MUST LIE AHEAD

Our Society has reached a size where it has outgrown even the fondest dreams of its founders and at the same time, has outgrown some of the "rules of government" set down for a much smaller group. It is our fond hope that the near future will witness a reorganization of our AES so as to make its government less unwieldy and to lessen the demand on those who form the Executive Board of the governing body.

My only regret in leaving the Executive Board is that I will not so often convene and converse with the many dedicated people who serve the Society in various capacities. I do intend however, to continue to attend as many out-of-town Branch meetings as I possibly can. I have urged this on the membership on many occasions and continue to offer these visitations as one of the privileges of membership in our Society. By observing and listening to others, you can improve both yourself and your Branch. Active Members make a good Branch and good Branches make a successful Society.

IN CONCLUSION

We have hopes of enjoying some of our avocations so sadly neglected these past five years by doing some active Scouting, canoeing, camping, fishing, hunting and maybe even improve our golf a little. Mrs. Wysong has already obtained a new golf bag and cart in anticipation of us spending more week-ends together.

My sincerest thanks to the many wonderful people I have had the privilege of working with while an officer of the AES for five happy years. Knowledge of the fact that our Society will continue to have dedicated people serving it makes its future look bright and gives us great satisfaction.

My thanks also to the Studebaker-Packard Corporation and its officials who made possible my five years of service to the American Electroplaters' Society.

FEATURES OF "OLD TIMERS NIGHT" THAT CLIMAXED EIGHTH INTERIM MEETING

(LEFT) "Old Timers" receive inscribed plates. Left to right, Raymond J. O'Connor, Bridgeport Branch; Albert O. Jaekle, New Haven Branch; William V. Coleman recipient for William T. Gray, Waterbury Branch, unable to be present; Vernon E. Grant, Hartford Branch; Philip W. Prouty, Springfield Branch. (RIGHT) Branch Presidents composed "Old Timers" Committee. President William C. Giesker, Waterbury; President Alexander R. Salmond, Springfield; Allen Ferguson, Interim Meeting Co-Chairman; President William Hyatt Jr., Bridgeport, Old Timers Night Chairman; President Walter J. Dyber, Hartford; Richard C. Barrett, Interim Meeting Co-Chairman; President Harry R. Taylor, New Haven.

EXECUTIVE SECRETARY'S REPORT

by

JOHN P. NICHOLS

THE nine-month fiscal period of American Electroplaters' Society, Inc. (AES) dating from July 1, 1960 through March 31, 1961 (span of this report) was a period of continued AES accomplishment beneficial to AES's sizable membership.

Yet an all-affecting economic recession distressed that period for practically everybody, including AES, as consequence of generally risen and rising costs and widely slipped and slipping sales, particularly during the last quarter of 1960 and the first quarter of 1961.

As periods of general business turbulence customarily do, that 1960-1961 fiscal span brought some AES membership losses in its wake.

Moreover, the drop in advertising revenue that so injuriously visited so many monthly magazine publishers, also reduced AES's income as publisher of PLATING MAGAZINE.

In consequence, AES's income did not, during that nine-month period, achieve even nearly the necessary volume estimated in the 1960-1961 operational budget passed by the Supreme Society at its Annual Meeting last July.

On the other hand, without diminution of any of AES's diverse services or any of its operational efficiency, AES's operational expenses, by diligent cost control, were contained well below the rate, generally, of the expense budget for the 1960-1961 fiscal year approved last July by the Supreme Society.

PART ONE

FINANCING OPERATIONS IN 1960-1961

It is manifestly impossible at this stage of the 1960-1961 fiscal year to marshal a complete financial statement for the full twelve-month fiscal period ending June 30, 1961. Such a certified financial statement will, of course, be provided after audit by Clyde A. Zukswert & Co., certified public accountants, and will, as usual, be published in the earliest possible issue of PLATING MAGAZINE after fiscal year termination on June 30, 1961.

The following, meantime, portrays AES/PLATING MAGAZINE operating performance during the nine-month period, July 1, 1960-April 1, 1961, latest fiscal period for which data are available as this is written, and compares that nine-month record with the corresponding 1959-1960 period.

INCOME	1959-1960	1960-1961
Society	$ 51,860	$ 49,287
PLATING	121,488	116,605
	$173,348	$165,892
EXPENSE		
Society	$ 56,968	$ 57,446
PLATING	116,510	115,133
	$173,478	$172,579

It must be added in passing that the 1960-1961 operating income data spread foregoing include none whatever yet of the $28,655 operating subsidy from the AES's General Fund authorized by the Supreme Society at its Los Angeles Annual Meeting, July 28, 1960, to be employed so as to balance the Society's estimated operating income and budgeted operating expense during the 1960-1961 (July 1-June 30) fiscal year.

Against the foregoing financial background, these AES developments, among others marked AES operation during the stated nine-month 1960-1961 fiscal period.

PART TWO

MEMBERSHIP STATUS IN 1960-1961

Structurally, the AES was and is composed principally of elected Active Members, Members-at-Large and Sustaining Members.

ACTIVE MEMBERS

The Society's Active Members, at this writing, are grouped into 60 chartered AES Branches distributed 52 in the United States, 5 in the Dominion of Canada and 3 in the Commonwealth of Australia. These Active Members in good standing by virtue of having paid 1960-1961 annual dues to AES Branches and for whom Branches, in turn, then paid Per Capita Taxes to the National Society to help maintain its vital over-all Society services and publishing operations, numbered 6917 at April 1, 1961 compared with 6970 on July 1, 1960.

Under the National Membership Committee, a regionalized and localized membership expansion campaign, buttressed by membership promotion visual aids supplied by National Headquarters, is now in progress, with Branch First Vice Presidents leading the drive at Branch level. As a result, it is possible that membership expansion ahead will, by fiscal year-end on June 30, 1961, offset the recession decrease experienced thus far in 1960-1961. And it seems realistic to forecast that with the return of economic normalcy, AES's membership will resume its upward climb.

MEMBERS-AT-LARGE

The ranks of AES's Members-at-Large are composed of individuals who though significantly interested in educational enrichment in the arts and sciences of electroplating, metal finishing and allied arts, nevertheless reside in areas and communities in the United States and Canada, and in far off places globally, not served by existent AES Chartered Branches.

Numbering 224 on April 1, 1961 compared with 246 on April 1, 1960, there is an apparent trend toward increase, and there is therefore prospect that AES will have approximately as many such members in good standing at fiscal year-end on June 30, 1961 as on June 30, 1960.

SUSTAINING MEMBERS

The financial sustenance of the AES's Research Program overwhelmingly stems from the $100 annual dues of the Sustaining Members of the Society, though a dollar of every Active Member's $7.50 annual Per Capita Tax and a dollar of every Member-at-Large's $11 annual dues are each also diverted to the exclusive credit and use of that vital Program. In the 1960-1961 fiscal year, it has embodied five continuing and two newly established Research Projects in American and Canadian universities, research institutions and elsewhere, focused upon respective phases

John P. Nichols

of electroplating and metal finishing warranting such research. These are detailed by the AES Research Committee Chairman elsewhere in this Annual Report.

At the six-month point of the 1960-1961 fiscal year, meaning at December 31, 1960, the Society's membership roster numbered some 349 American and Canadian industrial companies supporting AES Sustaining Memberships compared with 331 as of December 31, 1959. At the nine-month mark on April 1, 1961, however, Sustaining Memberships aggregated 339 compared with 350 on April 1, 1960, thereby demonstrating the extent of attrition that usually attends business recession as a result of attendant retrenchment in many companies.

Under the AES Research Committee's Vice Chairman for Finance, aided by National Headquarters, a drive to expand Sustaining Memberships quantitatively is gaining accelerated momentum. Regionally supervised by the Regional Research Finance Chairmen of the AES Research Committee, the program is being spearheaded at Branch level by Branch-appointed Branch Research Finance Chairmen.

It is revealing to note in passing that at fiscal year-end on June 30, 1960, AES's 350 Sustaining Memberships were credited for existence to some 42 of AES's 60 Branches, the Chicago Branch with 65 such memberships and the Detroit Branch with 63, then leading the procession. Eighteen AES Branches were then responsible for none. One of the goals of the 1960-1961 campaign is to inspire resultful Sustaining Membership expansion effort in these respective areas.

PART THREE

AES's STRENGTHENED ORGANIZATION

Education is the prime function of the AES. And despite rigidly controlled AES expense in the face of generally upward spiralling costs and lagging income, the Society's educational organization was nevertheless strengthened further during the nine-month fiscal period dating from July 1, 1960.

BRANCH EXPANSION

The complement of AES chartered Branches, for example, was increased in the Autumn of 1960 by the installation of the new Memphis-Midsouth Branch as the Society's 59th Branch. Moreover, the San Diego Branch, temporarily chartered November 1, 1960, was permanently chartered effective April 1, 1961, and will formally be installed as the AES's 60th Branch in May 1961. Furthermore, a new proposed Central Iowa Branch and a projected Palo Alto (California) Branch are now in the process of formation.

BRANCH REGIONALIZATION

So as to cultivate area educational and other AES Branch activities that lend themselves effectively to Branch collaboration regionally, the Society's so-styled Regional Groups or Councils swelled in 1960-1961 from six to eight, the additions being the AES Southwest Regional Council and the AES Far Western Educational Council. These 39 of AES's 60 currently chartered Branches are now therefore identified with these eight AES Regional Groups and Councils:

DIXIE GROUP (4): Blue Ridge, Memphis-Midsouth, Miami and Southeastern Branches

EMPIRE STATE GROUP (6): Buffalo, Capitol District, Mohawk Valley, Rochester, Southern Tier and Syracuse Branches

FARWESTERN GROUP (5): British Columbia, Los Angeles, Portland, San Francisco and Seattle-Puget Sound Branches

MIDWEST COUNCIL (6): Chicago, Milwaukee, Mississippi Valley, Rockford, St. Joseph Valley and St. Louis Branches

METROPOLITAN GROUP (2): Newark and New York Branches

NEW ENGLAND GROUP (5): Bridgeport, Hartford, New Haven, Springfield and Waterbury Branches

SOUTHWESTERN GROUP (6): Dallas-Fort Worth, Denver, Houston, Kansas City, Phoenix and Wichita Branches

TRI-STATE GROUP (5): Columbus, Cincinnati, Dayton, Indianapolis and Louisville Branches

Not only have these AES Regional Groups and Councils coordinated to expand AES's educational radiation in the arts and sciences of electroplating, metal finishing and allied arts by conducting important Regional Annual Educational Meetings in their areas but, in the following three instances, have also successfully collaborated to seek assignment from the Supreme Society to serve as regional hosts of AES Interim Meeting or of AES Annual Convention.

REGIONS AS NATIONAL HOSTS

The AES New England Regional Group was tapped by the Supreme Society in June 1959 to host the Eighth Interim Meeting. Consequently, that successful Eighth Interim Meeting of the Supreme Society was held at the Statler-Hilton Hotel, Hartford, Connecticut, February 11, 1961 under the aegis of that Regional Group, and drew representatives from 25 AES Branches from near and far. A feature was the "Old Timers Night" that followed that important all-day business meeting, at which the five oldest selected members of the respective Branches composing that AES Regional Group were that night recognized and colorfully honored.

The Society's 49th Annual Convention, as further example, will be held in June 1962 in Milwaukee, Wisconsin, arranged by the dynamic AES Midwest Regional Council, and will be the first time in AES history that an AES National Convention will be hosted by a Regional Group instead of a single AES Branch.

On the heels of hosting AES's memorable GOLDEN JUBILEE Interim Meeting in Atlanta, Georgia, in February 1959, AES's young but effective Dixie Regional Council will host the Society's 53rd Annual Convention. That anticipated large AES enterprise will be held in Miami Beach in June 1966.

Moreover, on May 5-6, 1961, the AES Empire State Regional Council, with five member Branches cooperating, will not only conduct its important two-day Annual Educational Meeting at the Manger Hotel, Rochester, but, concurrently, AES's host Rochester Branch that this year observes its own Fiftieth Anniversary as an AES chartered Branch, will also stage its AES GOLDEN JUBILEE.

The principal though more routine function of AES's eight Regional Groups, however, is to inspire their component Branches to conduct effective and well-attended Branch monthly educational meetings.

BRANCH EDUCATIONAL MEDIA

Just as the business of AES is education, so too is education the prime function of its 60 chartered Branches. In fulfilling their educational mission, some 15 AES Branches are currently sponsoring or conducting courses in electroplating or metal finishing, with more such Branch-sponsored electroplating curricula in the offing. The principal medium of Branch education, nonetheless, continues to be the Branch monthly educational meeting. It is estimated that some 590 such Branch monthly educational events will have occurred by terminal date of AES's fiscal 1960-1961.

The Society's most valuable tool for assisting Branch Educational Chairmen to select and schedule technical papers most likely to satisfy the tastes of their own specific Branches and therefore draw representative Branch audiences is the AES's Speakers List. Prepared creditably by Rafael Diaz of the AES's Educational Committee, and embodying titles and abstracts of a host of technical papers by authoritative technical speakers available for Branch scheduling, the 1959-1960 Speakers List was issued to all AES Branches by National Headquarters early in May 1960. In record time, the formidable 1960-1961 Speakers List by Mr. Diaz has been issued by the National Office even sooner in 1961.

In many of AES's 60 American, Canadian and Australian Branches, the monthly educational meeting has earned a high estate of meaning and effectiveness. The Society's goal is that highest possible standard shall be attained by all AES Branches. And to this end, AES's Public Relations Committee, after a year's study, completed a statement of 16 suggestions for enhancing quality. This statement has not only been issued to all AES Branches by National Headquarters but was also published in full in the August 1960 issue of PLATING MAGAZINE.

One large AES Branch's use of that statement is worthy of comment here. That Branch vested the responsibility

of providing its members with high quality education at monthly Branch meetings by appointing a Branch Educational Chairman and two qualified assistants. It conducted a poll of its members to determine exactly the type of technical knowledge needed in that particular Branch. By employing the AES Speakers List to the end of obtaining qualified speakers on those particular areas of technical interest, it consequently programmed Branch meetings wherein its members found knowledge in the areas of their personal interest.

The recent formation of the AES's Far West Educational Council through which the Society's five Pacific Coast Branches recently banded together to stimulate even greater traffic of qualified technical speakers is but another example of the AES's effort in 1960-1961 to upgrade Branch educational meetings to an even higher plane of performance, so that those thirsting for knowledge in electroplating, metal finishing and allied arts will, in all AES Branches, find it.

MEMBERS' HONORS AND RECOGNITION

The Society has consistently encouraged its members to share their technical and scientific knowledge by preparing and submitting effective technical papers for publishing consideration by its PLATING MAGAZINE or National Convention. According to AES's 1959-1960 Paper Awards Committee, the bulk of the 88 technical papers published in PLATING MAGAZINE or in TECHNICAL PROCEEDINGS in 1959-1960 were "outstanding in quality." The bulk of the 78 technical papers that appeared in PLATING MAGAZINE or in TECHNICAL PROCEEDINGS during AES's fiscal year 1960-1961 were given substantially similar appraisal by the 1960-1961 Paper Awards Committee.

Its Paper Awards are the Society's means for recognizing and rewarding the distinguished educational accomplishments of its members and other technical contributors. Its highest such award is the Carl E. Heussner AES Gold Medal Award for the best technical paper published in PLATING MAGAZINE or in TECHNICAL PROCEEDINGS during the fiscal year. Supplementary annual awards of this type are the AES Silver Medal and the AES Bronze Medal.

In addition, the Society had five annual awards in 1959-1960 for recognizing the best published papers during the fiscal year, on specific phases of electroplating, metal finishing and allied arts. In 1960-1961, AES added three more such awards for 1960-1961 presentation, namely the "Organic Finishing Award of AES" (sponsored by the O'Brien Corporation of South Bend, Indiana); the "Zinc Plating Award of AES" (sponsored by the American Zinc Institute) and the "Aluminum Finishing Award of AES" (sponsored by the Kaiser Aluminum & Chemical Corporation), thus making the annual total eleven instead of eight.

Aside from its eleven technical paper awards, AES also has the annual AES Scientific Achievement Award, the Society's highest scientific honor. Winners to date have been Dr. William Blum (1958), Dr. A. Kenneth Graham (1959) and Dr. Charles L. Faust (1960). The 1961 winner from among five endorsed nominees will be announced at the Opening Session of the coming AES Boston National Convention.

The Society also has the annual Charles Henry Proctor Memorial Leadership Award as its summit non-technical, non-scientific award. It was presented for the first time in 1960, and AES Past President Walter L. Pinner was the recipient. The 1961 Award will be made at the Farewell Banquet of the Boston National Convention to the selected stalwart from among seven endorsed nominees.

Highest membership grade for the AES member, of course, is election to AES Honorary Membership, a calculatedly select circle of long-time members of the Society who have rendered conspicuously meritorious service to the Society's goal, progress and international prestige. At present, the circle comprises fourteen living Honorary Members, with four more now endorsed for consideration by the Supreme Society this June.

The Society, its Branches, its members can well be proud of the zeal of AES's Paper Awards Committee, of its AES Scientific Achievement Award Committee, of its Proctor Award Selection Committee and of its Honorary Membership Awards Committee that are responsible for the selection or screening of recipients of these coveted AES honors.

PLATING MAGAZINE: AES's OWN JOURNAL

PLATING MAGAZINE is created monthly by AES's staff of publishing professionals of long standing. Technically and scientifically, these practitioners are bolstered by a qualified Editorial Board composed of scientific and technical experts.

To the largest audited paid international circulation in the electroplating and metal finishing field, half-century old PLATING MAGAZINE, the Society's fully owned official journal, means technical articles by experts that enrich the knowledge of its respective audited classifications of readers.

To the Society's members, from company president to foreman, from scientist to artisan, it also means coverage and interpretation of AES and Branch news and data of broad AES membership interest.

To them and to the substantial and growing number of AES non-members internationally who are also paid subscribers of PLATING year-after-year, it also means current industry and intersociety news—plus up to date information concerning equipment and supplies, patents, trade literature, article references, personals and other elements of balanced and reliable news coverage of the industry.

To its advertisers, it consequently means effective exposure of their product merchandising messages to a large segment of this market's purchasing power.

Charles B. Niebling
Member of the prominent law firm of Lum, Biunno & Tompkins, Newark, N. J., General Counsel of American Electroplaters' Society, Inc.

Clyde A. Zukswert
Head of Clyde A. Zukswert & Co., Newark's noted certified public accounting company, and AES's long-time Auditor.

Bob Wettstein
Head of Wettstein, Nowell & Johnson, Inc. PLATING MAGAZINE's award-winning Western Advertising Representative.

NATIONAL HEADQUARTERS IN 1960-1961

(1) Foyer of National Headquarters, in American Building, Newark, N. J. (2) The stenographic/clerical staff. (3) American Building's faithful Alonzo Parsons delivers a batch of daily mail to Office Manager Kathleen F. Duquette who is also PLATING'S Circulation Manager. (4) Thomas W. Lowe, Production Manager of PLATING MAGAZINE and AES's TECHNICAL PROCEEDINGS. (5) Rodney Leeds, Editor, PLATING and TECHNICAL PROCEEDINGS and Miss Sarah A. Desmond, his Secretary/Editorial Assistant. (6) Advertising Manager Sampson W. Freestone and Mrs. Loretta B. Ehrhardt, Secretary/Advertising Assistant. (7) A corner of the Mailing Department. (8) Miss Mary Lou Dowdell at busy mimeograph machine. (9) Preparing a bulk mail. At left Mrs. Patricia J. Schad, right Mrs. Loretta B. Ehrhardt. (10) Office Accountant Miss Kathryn H. Langan. (11) Ready for a meeting. (12) Miss Mary C. Canales, Secretary to John P. Nichols, National Executive Secretary of AES and publisher of PLATING MAGAZINE.

As elements of its continuing search for improvement, PLATING MAGAZINE added this year, an "AES Book Section"—a new advertising section for used or rebuilt equipment titled "MART"—a section titled "Branch Education"—a section on "Electroplating Courses"—and an enlarged and substantially emphasized section, "Future Meetings."

PLATING MAGAZINE is a member of the Audit Bureau of Circulations and of the Society of Business Magazine Editors. It is indexed in Applied Science and Technology Index, and, to name a few, is abstracted regularly in Chemical Abstracts, Metals Review, Metallurgical Abstracts, Engineering Abstracts, Engineering Index, Technical Data Index and Bulletin Analytique.

UPCOMING BOSTON NATIONAL CONVENTION

The AES conducted its 47th Annual Convention in Los Angeles, California, July 24-28, 1960. That first Society Annual Convention held west of St. Louis in AES's half-century lifetime was a success from every standpoint, particularly educational. As against a pre-Convention attendance estimate and "breakeven" pegged at 800 AES adults and children, it actually drew 1250 AES members and their families, including 141 children. Beyond the benefit of educational enrichment brought to AES members by some 30 presented technical papers, including a vaunted Symposium on "Hydrogen Embrittlement in Metal Finishing," that Convention benefitted the AES's General Fund to the extent of $1,526 profit.

Featuring another educational program of broad significance, including a two-session "Finishing of Light Metals" Symposium, the AES's upcoming 48th Annual Convention —to be held in Boston, Massachusetts, June 18-23, 1961— will also offer a suitable complement of fellowship and fun to be enjoyed by AES members during "off duty" hours and by the ladies and youth of AES. Mayor John F. Collins has already proclaimed that Convention week as "American Electroplaters' Society Week in Boston." Governor John A. Volpe has added his gubernatorial greetings.

As with last year's Los Angeles Convention and its predecessors, the 48th Annual Convention is an example of effective cooperation among an enthused Host Branch— an industrious Convention Committee ably led by General Convention Chairman Louis V. Gagnon—a diligent Editorial Board that has provided seasoned supervision and direction to the fashioning of educational sessions—and, finally, National Headquarters that not only has conceived, written, designed and published all Convention promotion and publicity material that has been given international attention through its PLATING MAGAZINE but which has also extended other specialized assistance to the Convention and its leadership.

PART FOUR

NATIONAL HEADQUARTERS IN 1960-1961

With gained and gaining longevity, maturity and effectiveness, the staff of AES/PLATING personnel handpicked and developed at National Headquarters by your Executive Secretary since the commencement of his tenure in June 1956 is making a sound record in service to AES itself and to its PLATING MAGAZINE and Research Program by the noteworthy quantity and quality of its output. Quantitatively, that staff still numbers a quality dozen men and women.

Base of operations is the AES's efficient and pleasant though unpretentious third-floor office in the four-story American Building, conveniently located on Broad Street, in the very path of the business and professional expansion of industrially swelling Newark, largest municipality of New Jersey.

Here exist, for instance, AES's modern records—records large in number, complexity and in the physical and mental demands of keeping them current, accurate and actively functioning as to AES's host of Active Members; Honorary Members; Sustaining Members; Members-at-Large; non-member PLATING MAGAZINE subscribers; non-member book purchasers; Research Program personnel; advertisers; standing and special committees and other such categories. Besides being subject to fiscal scrutiny by Clyde A. Zukswert & Co., independent certified public accountants, they are source of PLATING MAGAZINE's semi-annual Publisher Statements, and for annual audit by the Audit Bureau of Circulations.

Here too is the hub of that staff's activity in coordinating and centrally serving AES, a large multi-Branch international educational Society—a Society 1) with a farflung membership and diverse educational interests and activities; 2) with sizable educational publishing duties; 3) with the challenging and demanding responsiblities of operating PLATING MAGAZINE, a moderately large-scale monthly magazine; 4) with the function of publishing the Society's internationally anticipated annual book TECHNICAL PROCEEDINGS embodying, among other significant contents, each technical paper presented at the year's AES National Convention, together with the transcript of the discussion that attended the delivery of each such technical paper.

It is interesting to note in passing that, though the AES's National Convention occurred in Los Angeles, California, July 24-28, 1960, the lauded 1960 Edition of TECHNICAL PROCEEDINGS containing all the technical papers, and the discussion thereof, of that Convention was nonetheless actually printed and disseminated by mid-November 1960—a publishing record.

It also appears worth mentioning in this account, that, so as to assure that PLATING MAGAZINE's classification of its subscribers by number, function and geographical location shall be constantly and consistently up to date at National Headquarters for Audit Bureau of Circulations audit, a Return Sheet was recently issued to all PLATING subscribers internationally. It is revealing that nearly 50 per cent of such Return Sheets issued were executed and returned by subscribers within ten days of issuance, with the flow, of course, continuing.

Apart from day-to-day correspondence and other routine elements of its complex duties, it is estimated, moreover, that the National Office created and distributed among AES Delegates, Committees, Branches, Advertisers, Subscribers, Non-Members interested in AES membership and others, some 140 bulk mails filling nearly 48,000 envelopes or other mailing containers in the nine-month period from July 1, 1960 to April 1, 1961.

AES's BOOK PUBLISHING PROGRAM

The broadened book publishing program upon which AES embarked in 1959-1960 developed during the current fiscal year 1960-1961 as follows.

In 1959-1960, the Executive Board empowered your National President and your National Executive Secretary to enter the AES into a contract with a leading scientific book publishing company by which said publisher will publish, in book form, the technical papers delivered by experts before the AES's "Hydrogen Embrittlement in Metal Finishing Symposium" at the 1960 Los Angeles National Convention, after said papers had first appeared,

LIEUTENANT GOVERNOR ARRIVES
TO LAUNCH AES's LOS ANGELES CONVENTION

(Left to Right) Robert L. Giesel, president, National Association of Metal Finishers; John P. Nichols, National Executive Secretary, American Electroplaters' Society; Ralph D. Wysong, then-National President, American Electroplaters' Society; Stephen D. Gavin, Deputy Mayor of Los Angeles; Glenn M. Anderson, Lieutenant Governor of California; Paul F. Glaser, Convention Keynote Speaker; Raymond F. Ledford, president, Metal Finishing Suppliers' Association.

of course, in the AES's book TECHNICAL PROCEEDINGS (1960 Edition).

The book, now in production and targetted for late Summer or early Autumn 1961 published availability, will not only include the delivered hydrogen embrittlement Convention papers themselves, but also additional data on hydrogen embrittlement marshaled by Dr. Harold J. Read, Professor of Physical Metallurgy, Pennsylvania State University, AES Editor of that special AES book.

In 1959-1960, moreover, your National President and your National Executive Secretary were also empowered by the Executive Board, and did enter the AES into a contract with another scientific book publishing company to publish a reprint edition of the AES book, "Fundamentals of Electrochemistry and Electrodeposition" by Dr. Samuel Glasstone, that was initially published and copyrighted by the Society in 1943. Containing a new Foreword by Dr. Glasstone, the up-to-date little book actually made its appearance in the Autumn of 1960, and has had gratifying reception and sale, internationally, ever since.

In 1961, your National President and National Executive Secretary were empowered by the Executive Board, furthermore, and did enter the Society into a contract with the same leading scientific publishing company that is publishing the "Hydrogen Embrittlement" book, to publish in a book dwelling upon "Finishing of Aluminum," the four "Aluminum Finishing" papers that will compose part of the AES's "Finishing of Light Metals" symposium at its Boston National Convention, June 18-23, 1961. These four are being supplemented by six additional "Aluminum Finishing" papers, created by experts, that are being assembled and readied for book publication by Dr. Gerald H. Kissin of the Kaiser Aluminum & Chemical Corporation, AES Editor of this particular special AES book.

It is consequently expected that by mid-1962, the American Electroplaters' Society, in addition to the Glasstone book's reprint edition, will have fostered the publication of two special books enhancing education in specific phases of electroplating and metal finishing—with more, hopefully, in the offing. In this connection, the Society gladly expresses thanks for creditable contribution to its Publications Committee, especially to Dr. Samuel Heiman, Chairman of that Committee.

COOPERATION WITH OTHER ASSOCIATIONS

Years ago, AES recognized the worth and significance of cooperation, and today its relationship of mutuality with other technical, scientific and professional Associations and Societies in matters of common interest, and with others dealing with it, is among the Society's most-prized assets. National Headquarters and some fifteen AES liaison representatives are working with such Associations and Societies.

In the development of this phase of its progressing public relations program, the AES also had opportunity in 1960-1961 to cooperate even more actively in matters of mutual interest with the National Science Foundation (Office of Scientific Information); the International Cooperation Administration; the U. S. Department of Labor (Bureau of Labor Security); the U. S. Department of Labor (Bureau of Labor Statistics); the Science Research Associates; the U. S. Department of Commerce (Office of Trade Promotion) and others. With respect to the Office of Trade Promotion, this amplification appears desirable.

So as to spread education and knowledge in electroplating, metal finishing and allied arts on an even wider overseas scale, and to cooperate with the Trade Missions Program, Office of Trade Promotion of the United States Department of Commerce to the extent possible, PLATING MAGAZINE recently provided some 25 governmental libraries with a limited quantity of recent back PLATING MAGAZINE issues, as requested by the Director of that program.

The U. S. Trade Missions Program spearheads the international trade expansion activities of the U. S. Department of Commerce and tells the rest of the world the facts about U. S. private enterprise. On May 20, 1960, the Freedoms Foundation at Valley Forge presented its George Washington Honor Medal Award to that Program, "... For Outstanding Achievement in Bringing About a Better Understanding of the American Way of Life."

PERSONAL CONTACT WITH AES BRANCHES

All six National Officers shared during the fiscal year in the pleasant duty of visiting AES Branches and Regions. Though the demands of National Headquarters, of PLATING MAGAZINE, of the Research Program, of the Executive and Editorial Boards and of other AES business, public relations and publishing affairs, necessarily limited his Branch itinerary, this writer, nonetheless managed, happily, to visit eleven Branches and four AES Regional Councils or Groups since July 1, 1960. In fact, he addressed meetings of the St. Louis, Kansas City, Wichita, Houston and Dallas-Fort Worth Branches on practically successive evenings in October 1960.

With National President W. Andrew Wesley, he comprised the National Officer team, moreover, that installed the AES's new Memphis-Midsouth Branch in Memphis on October 21, 1960, and with First Vice President Chester G. Borlet will install the new San Diego Branch in that community before the coming Boston National Convention.

IN CONCLUSION

Any and all AES progress is naturally the collaborative handiwork of many AES elements, including the Supreme Society; the Executive Board, Branches and Branch leadership; Standing and Special Committees; PLATING MAGAZINE and Convention paper authors; members, individually and collectively, here and abroad—plus, of course, the staff at Headquarters that, as stated, demonstrated itself notably by the quality and quantity of its output in 1960-1961 as before.

Congratulations to each of the foregoing segments of the Society are extended here—with a special aside of appreciation directed to each of those associated with AES as staff.

INSTALLATION OF AES's 59TH BRANCH — MEMPHIS, TENN., OCTOBER 21, 1960

(1) Left to right, Branch Secretary Philip R. Dickinson, National President W. A. Wesley, National Executive Secretary John P. Nichols, City Commissioner William Farris, Branch President Edward L. Lorenzen and Memphis Chamber of Commerce Executive Vice President John P. Ellis. (2) National President W. Andrew Wesley presents Memphis-Midsouth Branch charter to Branch President Edward L. Lorenzen.

RESEARCH CHAIRMAN'S REPORT

by

DR. D. GARDNER FOULKE

THE Research Program is moving forward at a somewhat quickened pace, although expenditures have not yet been brought up to income. Consequently, as reported elsewhere, the Research Fund is in excellent condition and this is in no small way due to the efforts of the Vice Chairman of Finance, his Supervisors and the Branch Research Chairmen. The continued stress on quality of electrodeposits, both for decorative and engineering applications, underscores the continuing need for AES Research at an accelerated rate. During the year considerable groundwork has been laid to permit the Research Program to move in that direction.

GENERAL

Seven projects were approved by the Research Committee for the year. One of the new projects at the time of the writing of this report has been unable to locate a Fellow to carry out the work. Final reports have been received from three projects, Nos. 10, 13, and 17. No longer active as far as financial support is concerned, they are nonetheless still making worthwhile contributions to the Research effort.

PUBLICATIONS

Since the last Research Chairman's report four Serial Reports have been published, No. 42, No. 43 and No. 45 on "Cleaning and Preparation of Metals Prior to Electroplating" and No. 44 on "The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating."

A paper by Dodge and Sondak, published in the February and March PLATING, is the final report of Project No. 10, and articles by Ogburn and Roberts and Ogburn and Ernst in the February and May issues of PLATING present the final reports for Project No. 13.

Three papers to be presented at the 1961 Convention properly represent activity of the Research Committee this fiscal year. These are a general paper by the Research Committee Chairman, a report by Walter Pinner on Project 15 and by Dr. Jones on Project 14.

STATUS OF RESEARCH PROJECTS

PROJECT 12—Cleaning and Preparation of Metals for Electroplating

Laboratory work is under way to determine the effect of soils on overpotential and the kinetics of electrodeposition of metals. Equipment problems have been overcome and presently switching times of 5×10^{-7} seconds can be reached. By the end of the fiscal year a considerable amount of valuable data will be obtained.

PROJECT 14—The Influence of Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating.

The study of chromium plating is continuing—presently by motion picture studies in an effort to understand the cracking phenomenon.

PROJECT 15—Accelerated Corrosion Tests for the Performance of Plated Coatings

This project is proceeding along established lines to further standardize the Corrodkote and CASS tests. With respect to the former, a four-hour test is felt to be inadequate as a specification for interior parts and studies of the type of kaolin and per cent humidity are under way.

PROJECT 16—The Mechanism of Electrodeposition

The fundamental studies are continuing in the realm of the kinetics of electrodeposition. Present efforts are concerned with the electrodeposition of copper from the simple copper sulfate bath, and the same bath containing organic compounds, in an effort to determine the effect of adsorption on the mechanism of deposition.

PROJECT 18—Mechanical Finishing of Metal Surfaces

The first phase of this work, that is, the polishing and buffing of zinc die castings using bar compounds, has been completed. Similar tests are now being carried out with liquid compounds.

Dr. D. Gardner Foulke

Continued and increasingly generous support of the Research Program by the Sustaining Members is not only gratifying, but also will make possible the inauguration of new projects in the near future. With this in view, five Task Committees are actively evaluating proposed research areas to determine whether said areas are the basis of proper and desirable Research Projects to be undertaken by the American Electroplaters' Society.

RESEARCH CONFERENCE

A Research Conference attended by all members of active Research Projects as well as the technical representatives of a number of Sustaining members was held in April at the Bell Telephone Laboratories at Murray Hill, N. J. The activities of all of the Projects were reviewed and a worthwhile exchange of ideas occurred, leading to better coordination and cooperation among the projects. One session was devoted to "Needed Research" and it is felt that the results of the conference were so worthwhile that similar meetings should be held from time-to-time in the future.

CONCLUSION

Your Research Committee has been most active this year. All research activity is now adequately covered by formal contracts. Considerable effort has gone into planning for the future by activating and following up on Task Committees. Final reports have been submitted by all completed Projects and two new Projects were undertaken. The Vice-Chairman-for-Finance-Supervisor structure based upon the regional plan has been crystallized and is now functioning.

The progress made during the year was the result of team effort by the Research Committee, the Project Committee Members, Directors and Fellows, the District Research and Finance Supervisors, and the Research Conference Committee. To all these sincere workers and especially to the Sustaining Members who made the whole thing possible go the heartfelt thanks of the retiring Chairman.

RESEARCH COMMITTEE CHAIRMEN

1923–1924	William Delage	1949–1950	William M. Tucker
1924–1925	R. L. Shepard	1950–1951	Dr. W. Andrew Wesley
1925–1926	Frank J. Hanlon	1951–1952	G. M. Cole (Died Aug. '51)
1926–1929	R. J. O'Connor		Dr. Donald Price
1929–1933	Jacob Hay	1952–1953	Dr. Donald Price
1933–1936	William M. Phillips	1953–1955	Dr. Earl J. Serfass
1936–1938	George B. Hogaboom	1955–1956	Leslie C. Borchert
1938–1941	Austin B. Wilson	1956–1957	Arthur H. DuRose
1941–1943	Erwin Sohn	1957–1958	Robert A. Ehrhardt
1944–1946	Carl E. Heussner	1958–1959	Dr. Russel E. Harr
1946–1947	Ellsworth T. Candee	1959–1960	James D. Thomas
1947–1948	Dr. Richard M. Wick	1960–1961	Dr. D. G. Foulke
1948–1949	Dr. Louis Weisberg		

SUMMARY OF AMERICAN ELECTROPLATERS' SOCIETY RESEARCH PROJECTS 1960-1961

Project	Location	Project Director	Committee Chairman	Fellow	Subject	Status
12	Columbia University	Dr. H. B. Linford	E. T. Candee	L. Karasyk	Cleaning and Preparation of Metals for Electroplating	Active
13	Bureau of Standards	Fielding Ogburn	C. H. Sample		Nature, Cause, and Effect of Porosity in Electrodeposits	Inactive
14	Ontario Research Foundation	Dr. M. H. Jones	W. M. Tucker	J. C. Saiddington	Influence of Physical Metallurgy and Mechanical Processing of Basis Metal on Electroplating	Active
15	Detroit Area	None	W. L. Pinner	None Needed	Accelerated Corrosion Tests	Active
16	University of Pennsylvania	Dr. J. O'M. Bockris	E. Bowerman	H. Kita	Mechanism of Electrodeposition	Active
17	Virginia Institute for Scientific Research	Dr. H. Leidheiser Jr.	A. H. DuRose		Microthrowing Power	Inactive
18	Chicago Area	W. C. Geissman	R. S. Modjeska	K. Gatchel W. Fox	Mechanical Finishing of Metal Surfaces	Active
19	Bureau of Standards	Fielding Ogburn	A. Mendizza	None	Galvanic Effects Associated with Coating Failure	Active
20	Dallas-Fort Worth Area	None	M. E. Browning W. Aves	Dr. R. L. Hoyle	Plating by Thermal Decomposition	Active

THE RESEARCH COMMITTEE (1960-1961)

Dr. William Blum
Honorary Member

Dr. H. J. Wiesner
Vice Chairman
Research

Dr. D. G. Foulke
Chairman

Raymond L. Mitchell
Vice Chairman
Finance

John P. Nichols
Secretary-Treasurer

Whitney Snyder
Member

Dr. B. B. Knapp
Member

Edward J. Kubis
Member

Richard A. Fellows
Member

Walter E. Moline
Member

I. M. Weiss
Member

Dr. E. R. Bowerman
District Supervisor

Clarence H. Sample
District Supervisor

James D. Thomas
District Supervisor

Clyde Kelly
District Supervisor

Cleveland F. Nixon
District Supervisor

Kergan Wells
Canadian Fund
Custodian

BRANCH DELEGATES COMPOSING THE SUPREME SOCIETY

The AES's highest governing council, known as "Supreme Society" is composed of three duly elected Delegates from each of the 60 chartered AES Branches. Accredited by the Credentials Committee, these Delegates, as a body, are the governors and lawmakers of this Society in its fifty-second year (1960-1961).

ADELAIDE
1. M. K. Birrell
2. T. F. Pearce
3. R. J. Down

Alternates
1. W. E. Minahan
2. Jeffrey V. Strugnall
3. H. F. Watson

ALLENTOWN-READING
4. Joseph Ross
5. Robert Steinmetz
6. Harold Bowen

Alternates
4. Joseph Hammerl
5. Edgar Iobst
6. Franklin Welch

BALTIMORE-WASHINGTON
7. Arthur G. Pierdon
8. Edward E. Oberland
9. Harold W. Scott

Alternates
7. Edward Roach
8. Fielding Ogburn
9. Jules Horelick

BLUE RIDGE
10. T. R. Boggess
11. Michael Milo
12. Donald H. McGee

Alternates
10. Dr. Nelson Murphy
11. Howard Welfare
12.

BOSTON
13. George P. Swift
14. Manson Glover
15. George J. Marotta

Alternates
13. Hubert H. Foley
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   GEORGE SCHORE, George Schore & Associates, Inc.
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11. Society of Aircraft Materials & Process Engineers (SAMPE)
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12. The Electrochemical Society, Inc.
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(As at April 1, 1961)

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Secretary-Treasurer: R. J. Down
13 Sedgeford Rd., Myrtle Bank, South Australia
Meeting Place: 17 Waymouth St., Adelaide
Day of Month: Various
Time: 6:00 P.M.
Sustaining Members:
None

ALLENTOWN-READING

Secretary-Treasurer: John B. Ernst
North Garden Apts, C-2, Doylestown, Pa.
Meeting Place: Scotty's Anchorage, Emmaus, Pa.
Day of Month: Fourth Thursday
Time: 7:00 P.M.
Sustaining Members:
Bethlehem Steel Co. (2), Bethlehem, Pa.
L. F. Grammes & Sons, Inc., Allentown, Pa.
The New Jersey Zinc Co. (of Pennsylvania), Palmerton, Pa.

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Secretary: Joseph Eisenberg
1800 Cherry Hill Rd., Baltimore 30, Maryland
Meeting Place: Chemistry Bldg., National Bureau of Standards, Washington 25, D. C.
and
The Regent House Hotel, Baltimore, Md.
Day of Month: Second Tuesday
Time: 8:00 P.M.
Sustaining Members:
Allied Research Products, Inc., Baltimore 5, Md.
American Instrument Co. Inc., Silver Spring, Md
E. I. duPont de Nemours & Co., Inc., Wilmington 98, Del.

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Secretary-Treasurer: Donald H. McGee
3045 Gilmer Ave., Winston-Salem, N. C.
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Day of Month: First Friday
Time: 6:30 P.M.
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Day of Month: First Thursday
Time: Dinner 6:00 P.M.—Meeting—8:00 P.M.
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Day of Month: Second Friday
Time: 8:00 P.M.
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Secretary: Claus Schlossareck
3557 Tanner St., Vancouver, B. C.
Meeting Place: Lougheed Hotel, Lougheed Hwy., Willingdon, N. Burnaly, B. C.
Day of Month: Last week normally
Time: 6:30 P.M.

BUFFALO

Secretary: C. Eich
1081 S. Campbell Blvd., North Tonawanda, N. Y.
Meeting Place: Niagara Manor, 899 Niagara Falls Blvd., Buffalo, N. Y.
Day of Month: 1st Friday
Time: 6:30 P.M. Dinner—Meeting 8:00 P.M.
Sustaining Members:
Van Der Horst Corporation of America, Olean, N. Y.

CAPITOL DISTRICT

Secretary: Edward Q. Legere
100 Skyway Drive, Scotia 2, N. Y.
Meeting Place: Circle Inn, Latham Circle, N. Y.
Day of Month: First Monday
Time: 7:00 P.M.
Sustaining Members:
Sprague Electric Co. North Adams, Mass.

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2400 E. Mt. Hope, Okemus, Michigan
Meeting Place: Roosevelt Hotel, Lansing, Mich.
and
Hayes Hotel, Jackson, Mich.
Day of Month: First Tuesday
Time: 7:00 P.M. (Dinner Meeting)
Sustaining Members:
None

CHICAGO

Secretary-Treasurer: Paul Glab
882 N. Paulina St., Chicago 22, Ill.
Meeting Place: Stella's Restaurant, 3206 N. Kostner Ave., Chicago, Ill.
Day of Month: 2nd Friday of each Month
Time: Dinner 6:15—Meeting 7:15
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Allied Industrial Products, Inc., Chicago,
American Can Co., Maywood, Ill.
American Nickeloid Co., Peru, Ill.
Amerock Corporation, Rockford, Ill.
Amphenol Borg Electronics Corporation, Chicago 50, Ill.
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Ekco Products Co., Chicago 39, Ill.
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The Meaker Co., Chicago 50, Ill.
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Mercil Plating Equipment Co., Chicago, Ill.
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Metalwash Machinery Corp., Barrington, Ill.
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Plating Service Co., Chicago 39, Ill.

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Sunbeam Corp., Chicago 50, Ill.
Technic, Inc., Chicago 26, Ill.
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Van Straaten Chemical Co., Chicago, Ill.
Western Electric Co., Inc., Chicago 23, Ill.
Western Rust-Proof Co., Chicago, Ill.

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Secretary: David L. Kaplan
817 Sabino Court, Cincinnati 31, Ohio
Meeting Place: Engineering Society Headquarters, Cincinnati
Day of Month: Fourth Wednesday
Time: Dinner 6:30 P.M.—Meeting 7:30 P.M.
Sustaining Members:
Products Finishing, Cincinnati, Ohio

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260 Valley View Dr., Chesterland, Ohio
Meeting Place: Cleveland Engineering Societies' Building
Day of Month: First Friday
Time: 8:00 P.M.
Sustaining Members:
Acme Plating Co., Cleveland, Ohio
Advance Plating Co., Cleveland, Ohio
Cowles Chemical Co., Cleveland, Ohio
Diamond Alkali Co., Chromium Chemicals Division, Cleveland 14, Ohio
Eaton Manufacturing Co., Cleveland 10, Ohio
Harshaw Chemical Co. (2), Cleveland, Ohio
R. O. Hull & Co., Inc., Rocky River 16, Ohio
Incar, Inc., Cleveland 13, Ohio
The Kelly Plating Company, Cleveland, Ohio
Lorence Plating Co., Cleveland 4, Ohio
The McGean Chemical Co., Cleveland 9, Ohio
Pittsburgh Steel Co., Thomas Strip Div., Warren 14, Ohio
Platers Supply Co., Cleveland 14, Ohio
Precision Castings Co., Division of Precasco Corporation, Cleveland 11, Ohio
Republic Steel Corp., Cleveland, Ohio
Rockwell-Standard Corp., Newton Falls, Ohio
Talon, Inc., Meadville, Pa.
True Temper Corporation, Geneva, Ohio

COLUMBUS

Secretary: Mary R. Fulmer
273 Eastmoor Blvd., Columbus, Ohio
Meeting Place: Battelle Memorial Institute, Columbus, Ohio
Day of Month: First Friday
Time: 8:00 P.M.
Sustaining Members:
None

DALLAS-FORT WORTH

Secretary-Treasurer: T. E. Betz
3124 Hillglenn Road, Dallas 28, Texas
Meeting Place: Howard Johnsons', Dallas-Ft. Worth Turnpike
Day of Month: Third Wednesday
Time: 6:30 P.M.—Dinner—8:00 P.M.—Meeting
Sustaining Members:
Lane Plating Works, Dallas, Texas

DAYTON

Secretary: Duane Prosser
3836 Woodman Dr., Dayton 29, Ohio
Meeting Place: Hotel Dayton-Biltmore, Dayton, Ohio
Day of Month: Third Wednesday
Time: 8:00 P.M.
Sustaining Members:
Dayton Rust Proof Co., Dayton, Ohio
National Cash Register Co., Dayton, Ohio
Rack Processing Co., Dayton 9, Ohio
Rawac Plating Co., Springfield, Ohio

DENVER

Secretary: Elmer A. Schuster
8540 No. Essex St., Denver 29, Colo.
Meeting Place: Oxford Hotel

DETROIT

Secretary-Treasurer: Guy Cummings, Jr., Frederick B. Stevens, Inc.
1800-18th St., Detroit 16, Mich
Meeting Place: Hotel Statler, Detroit, Mich.
Day of Month: First Friday
Time: 8:00 P.M.
Sustaining Members:
Benchmark, Inc., Wyandotte, Mich.
Bruce Products Corp., Howell, Mich.
Buckingham Products Co., Detroit 27, Mich.
Chrysler Corp. (2), Detroit, Mich.
Congress Die Casting Div. (Tann Corporation), Detroit 34, Mich.
Detrex Chemical Industries, Inc., Detroit 32, Mich.
Douglas & Lomason Co., Detroit 8, Mich.
Ford Motor Co. (5), Detroit 39, Mich.
Formax Manufacturing Corp., Detroit, Mich.
General Motors Corporation, Research Staff (5) Warren, Mich.
Grand Steel & Mfg. Co., Clawson, Mich.
Harshaw Chemical Co., Detroit, Mich.
Heatbath Corp., Detroit, Mich.
Higgins Rack Coating & Mfg. Co., Warren, Mich.
Hoover Ball & Bearing Co., Saline, Mich.
Houdaille Industries, Inc., Huntington, West Va.
Howard Plating Industries, Inc., Royal Oak, Mich.
Kaybar, Inc., Birmingham, Mich.
King-Seeley Division or King-Seeley Thermos Co., Ann Arbor, Mich.
Metal & Thermit Corp., New York, N. Y.
Michigan Chrome & Chemical Co., Detroit, Mich.
Midwest Chrome Process Co., Detroit 9, Mich.
George L. Nankervis Co., Detroit 27, Mich.
National Mfg. Co., Warren, Mich.
Nelson Chemicals Co., Detroit 27, Mich.
Northwest Chemical Co., Detroit 4, Mich.
Pillsbury Chemicals, Detroit, Mich.
Plating Inst. of Michigan, Lincoln Park, Mich.
Reilly Plating Company, Melvindale, Mich.
Seco Chemicals, Inc., Detroit 10, Mich.
J. J. Siefen Company, Detroit 9, Mich.
Siefen Compounds, Inc., Detroit 38, Mich.
Solventol Chemical Products, Inc., Detroit 3, Mich
Frederic B. Stevens, Inc. (2), Detroit 16, Mich.
Superior Polishing Company, Van Dyke, Mich.
Trilex Corporation, Wayne, Mich.
The Udylite Corp. (3), Detroit 11, Mich.
United Platers, Inc., Detroit, Mich.
Univertical Corporation (5), Detroit, Mich.
Whitfield Chemical Co., Detroit, Mich.
Willow Run Rubber & Lining Co., Belleville, Mich.
Wyandotte Chemicals Corp., Wyandotte, Mich.

GRAND RAPIDS

Secretary: Bernard Kumko
853-1st St., N.W., Grand Rapids, Mich.
Meeting Place: Scotties Restaurant-"Trader Room"
Day of Month: Second Friday
Time: 7:00 P.M.
Sustaining Members:
Abrado Finish Corporation, Grand Rapids, Mich.
Automatic Music, Inc., Grand Rapids, Mich.
Doehler-Jarvis Division of National Lead Company, Grand Rapids, Mich.
P. B. Gast & Company, Grand Rapids, Mich.
Grand Rapids Brass Co., Grand Rapids, Mich.
Grand Rapids Plating Co., Inc., Grand Rapids 5, Mich.
Hammond Machinery Builders, Inc., Kalamazoo, Mich
Hanson-Van Winkle-Munning Co., (formerly J. C. Miller Division) Matawan, N. J.
Haviland Products Company, Grand Rapids, Mich.
Holland Die Casting & Plating Co., Holland, Mich.
Jervis Corporation, Grandville, Michigan
Keeler Brass Co., Grand Rapids, Mich.
Knape & Vogt Mfg. Co., Grand Rapids, Mich.
Master Finishing & Deburring Company, Grand Rapids 7, Mich.
Michigan Plating and Stamping Co., Grand Rapids 2, Mich.
Preston Products Co., Grand Rapids 4, Mich.
Synthetic Coating Co., Grand Rapids 2, Mich.
G. H. Walgren Company, Ada, Mich.

HAMILTON

Secretary: Allan G. Andrews
1380 Lewisham Dr., Clarkson, Ontario, Canada
Meeting Place: The Fischer Hotel, York St., Hamilton
Day of Month: Third Friday
Time: 8:15 P.M.
Sustaining Members:
Behr-Manning, Ltd., Brantford, Canada

HARTFORD

Secretary: Stanley Platoz
26 Erwin Place, New Britain, Conn.
Meeting Place: Veterans of Foreign Wars Bldg., South St., Elmwood, Conn.
Day of Month: Third Monday
Time: 7:45 P.M.
Sustaining Members:
Arrow Hart & Hegeman Electric Company, Hartford 6 Conn
The W. E. Bassett Co., Derby, Conn.
W. D. MacDermid Chemical Co., Bristol, Conn.
Royal Typewriter Company, Hartford, Conn.
The Stanley Works, New Britain, Conn.

HOUSTON

Secretary-Treasurer: James Garrett
117 Caylor, Houston, Texas

Meeting Place: Ram's Club Inc., 2710 Albany St., Houston, Texas

Day of Month: Third Tuesday
Time: 6:30 P.M.

Sustaining Member:
Dixie Electro Plating Company, Houston 3, Texas

INDIANAPOLIS

Secretary: Edna Rohrabaugh
RR No. 4, Lafayette, Indiana

Meeting Place: Construction League, 1456 N. Delaware St.

Day of Month: First Tuesday
Time: Dinner 6:30—Meeting 8:00 P.M.

Sustaining Members:
Arvin Industries, Inc., Columbus, Ind.
Guide Lamp Division, General Motors Corp., Anderson, Ind.
RCA Victor Div., Radio Corporation of America, Indianapolis, Ind.
Western Electric Company, Inc., Indianapolis 6, Ind.

KANSAS CITY

Secretary: Robert W. Davis
7817 Arlington, Raytown, Missouri

Meeting Place: Regan's Restaurant, 207 Southwest Blvd.

Day of Month: Second Thursday
Time: Dinner 7:00 P.M.—Meeting 8:00 P.M.

Sustaining Members:
The Bendix Corp., Kansas City 41, Mo.
Western Electric Co., Omaha, Nebraska

LANCASTER

Secretary-Treasurer: Martin S. Frant
AMP Inc.-Research Div., Harrisburg, Pa.

Meeting Place: Varies

Day of Month: Second Friday
Time: 8:00 P.M.

Sustaining Members:
None

LOS ANGELES

Secretary: Robert H. Pooler
19200 So. Western Ave., Torrance, Calif.

Meeting Place: Roger Young Auditorium, 926 W. Washington Blvd., Los Angeles, Calif.

Day of Month: Second Wednesday
Time: 7:00 P.M.

Sustaining Members:
Ajax Hardware Mfg. Co., Los Angeles County, Calif.
Alert Supply Company, Los Angeles 22, Calif.
Associated Plating Co., Los Angeles, Calif.
The Barber-Webb Co., Inc., Los Angeles 58, Calif.
Burton Silver Plating Co., Culver City, Calif.
L. H. Butcher Co., Los Angeles 23, Calif.
Crown City Plating Co., El Monte, Calif.
Hall Mack Company, Los Angeles 7, Calif.
McKesson & Robbins Inc., Los Angeles, Calif.
Modern Plating Co., Los Angeles, Calif.
George E. Nichols Plating, Los Angeles, Calif.
Peterson Plating & Processing Co., Glendale 1, Calif.
Price Pfister Brass Mfg. Co., Los Angeles 31, Calif.
Rheem Automotive Co., Fullerton, Calif.
Royal Plating Works, Los Angeles 21, Calif.
Standard Nickel-Chromium Plating Co., Los Angeles, Calif.
Surface Alloys Engineering Co., Huntington Park, Calif.
Turco Products, Inc., Los Angeles 54, Calif.
Virtue Bros. Manufacturing Co., Los Angeles 45, Calif.

LOUISVILLE

Secretary-Treasurer: Kenneth G. Reifsteck
3045 Nadina Way, Louisville 5, Kentucky

Meeting Place: Hasenours Dining & Cocktail Lounge, 1028 Barrett Ave., Louisville, Kentucky

Day of Month: Third Thursday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Members:
None

MELBOURNE

Secretary: Gordon John Perkins
21 Sharan Ave., Mordialloc S. 12, Victoria, Australia

Meeting Place: Metallurgy Theatre, Royal Melbourne Tech. College

Day of Month: Third Thursday
Time: 7:30 P.M.

Sustaining Members:
None

MEMPHIS-MID SOUTH

Secretary: Philip R. Dickinson
c/o Chapman Chemical Co., 60 N. 3rd St., Memphis, Tennessee

Meeting Place: American Legion Post #1, Conference Room, Memphis, Tenn.

Day of Month: 4th Friday
Time: 7:00 P.M.

MIAMI

Secretary: Abraham Schorr
510 N.E. 173 St., No. Miami Beach, Florida

Meeting Place: 5000 East 10 Court, Hialeah

Day of Month: 3rd Friday
Time: 8:00 P.M.

Sustaining Members:
None

MILWAUKEE

Secretary-Treasurer: Leslie L. Diveley
2936 N. 84 St., Milwaukee 10, Wis.

Meeting Place: Ambassador Hotel, Milwaukee, Wisc.

Day of Month: First Friday
Time: 8:00 P.M.

Sustaining Members:
Acme Galvanizing, Inc., Milwaukee 15, Wisc.
Allen Bradley Co., Milwaukee 4, Wisc.
Cutler-Hammer, Inc., Milwaukee, Wisc.
Donald Seles & Mfg. Co., Milwaukee 13, Wisc.
Kohler Co., Kohler, Wisc.
Milwaukee Plating Co., Milwaukee 12, Wis.
John Oster Mfg. Co., Milwaukee 17, Wisc.
Racine Plating Co., Inc., Racine, Wisc.
Square D Company, Glendale, Wisc.
S. K. Williams Co., Milwaukee 10, Wisc.

MISSISSIPPI VALLEY

Secretary-Treasurer: Clyde N. Shepherdson
1025 West Division St., Galva, Ill.

Meeting Place: Moline American Legion Hall, Moline, Ill.

Day of Month: Third Wednesday
Time: 8:00 P.M.

Sustaining Members:
None

MOHAWK VALLEY

Secretary-Treasurer: Henry J. Crouse
1414 Taylor Ave., Utica 3, N. Y.

Meeting Place: Twin Ponds Country Club

Day of Month: Second Thursday
Time: Dinner 6:30 P.M.—Meeting 8:30 P.M.

Sustaining Members:
None

MONTREAL

Secretary-Treasurer: George A. Katronge
4680 Dupuis Ave., Apt. 11, Montreal, Quebec, Canada

Meeting Place: Sheraton Mount Royal Hotel, 1455 Peel St., Montreal, P. Q.

Day of Month: Second Monday
Time: 8:30 P.M.

Sustaining Members:
Alloycraft, Ltd., Westmont, Montreal, Canada
Northern Electric Co., Ltd., Montreal, Quebec, Canada

NEWARK

Secretary: D. Gardner Foulke
455 Johnston Drive, Watchung, RFD 3, Plainfield, N. J.

Meeting Place: Robert Treat Hotel

Day of Month: Third Friday
Time: 7:45 P.M.

Sustaining Members:
American Metal Climax, Inc., New York 20, N. Y.
American Smelting & Refining Co., South Plainfield, N. J.
Bell Telephone Laboratories, Murray Hill, N. J.
The Electric Chain Co. of Canada, Ltd., Toronto, Ontario, Canada
Frederick Gumm Chemical Co., Kearny, N. J.
Hanson-Van Winkle-Munning Co. (2), Matawan, N. J.
Hy Grade Electro Plating Co., Newark 7, N. J.
International Nickel Company, Inc. (2), Bayonne, N. J.
Maas & Waldstein Co., Newark 4, N. J.
Polumbo Bros. Inc., Linden, N. J.
Sel-Rex Corporation, Nutley 10, N. J.
Western Electric Company, Kearny, N. J.

NEW HAVEN

Secretary-Treasurer: Leonard F. Roberti
232 Ellsworth Ave., New Haven 11, Conn.

Meeting Place: New Haven Motor Inn

Day of Month: Second Tuesday
Time: 8:00 P.M.

Sustaining Members:
Christie Plating Company, Groton, Conn.
Chromium Process Co., Shelton, Conn.
Corona Corporation, Jersey City 5, N. J.
Enthone, Inc., New Haven 2, Conn.
Lycoming Div., AVCO Mfg. Corp., Stratford, Conn.

NEW YORK

Secretary-Treasurer: Milton Nadel
162-41 Powell's Cove Blvd., Whitestone 57, N. Y.

Meeting Place: Hotel Statler

Day of Month: Second and Fourth Fridays
Time: 8:00 P.M.

Sustaining Members:
Allied Chemical Corp., Solvay Process Div., Syracuse 1, N. Y.
American Zinc Institute, Incorporated, New York, N. Y.
International Nickel Company, Inc. (3), New York, N. Y.
Lea-Ronal, Inc., Jamaica 35, N. Y.
Levco Metal Finishers, Inc., Long Island City 1, N. Y.
Magnuson Products Corp., Brooklyn, N. Y.
Metal & Thermit Corp., New York 17, N. Y.
Metals & Plastics Publications, Inc., Westwood, N. J.
Oakite Products, Inc., New York 6, N. Y.
Photocuits Corporation, Glen Cove, N. Y.

PHILADELPHIA

Secretary: I. William Marcovitch
1302 St. Vincent St., Philadelphia 11, Pa.

Meeting Place: Engineers' Club of Philadelphia, 1317 Spruce St., Philadelphia 7, Pa.

Day of Month: Fourth Monday
Time: 8:00 P.M.

Sustaining Members:
Accurate Electro-Plating, Inc., Philadelphia, Pa.
Aetna Electroplating Co., Inc., Philadelphia 11, Pa.
American Chemical Paint Co., Ambler, Pa.
Cleanite Products, Inc., Cornwells Heights, Pa.
General Plating Co., Trenton, N. J.
Pennsalt Chemicals Corporation, Philadelphia, Pa.
Philadelphia Rust Proof Co., Philadelphia 34, Pa.
Progress Mfg. Co., Inc., Philadelphia 34, Pa.
Radio Corporation of America, Camden 2, N. J.
The Reynolds Co., Philadelphia 32, Pa.

PHOENIX

Secretary: Paul Martin Wible
3622 E. Sheridan, Phoenix, Arizona

Meeting Place: Interlude Club, 3400 N. 60th St., Phoenix

Day of Month: Second Tuesday
Time: 8:00 P.M.

PITTSBURGH

Secretary: Clyde A. Mungall
7846 Thon Dr., Verona, Pa.

Meeting Place: Gateway Plaza, Pittsburgh, Pa.

Day of Month: Second Wednesday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Members:
Aluminum Company of America, New Kensington, Pa.
Rockwell-Standard Corp., Standard Steel Spring Div., Coraopolis, Pa.
Weirton Steel Co., Weirton, West Va.
Westinghouse Electric Corp., East Pittsburgh, Pa.

PORTLAND

Secretary-Treasurer: Edward Elkins
414 N.E. 84th Ave., Portland 20, Ore.

Meeting Place: Various

Day of Month: Open
Time: 6:30 P.M.

Sustaining Members:
None

PROVIDENCE-ATTLEBORO

Secretary: Clifford Healey
16 Herbert Dr., Greenville, R. I.

Meeting Place: Providence Engineering Society Building, 195 Angell St., Providence, R. I.

Day of Month: Third Monday
Time: 8:00 P.M.

Sustaining Members:
Gorham Manufacturing Co., Providence 7, R. I.
Walton & Lonsbury, Attleboro, Mass.

ROCHESTER

Secretary-Treasurer: Barrie M. Gardner
129 Ridgewood Rd., Rochester 15, N. Y.

Meeting Place: Rochester German Club, Rochester, N. Y.

Day of Month: First Monday
Time: 8:00 P.M.

Sustaining Members:
Eastman-Kodak Co. (2), Rochester 4, N. Y.
Taylor Instrument Companies, Rochester, N. Y.
Wollensak Optical Co., Rochester, N. Y.

ROCKFORD

Secretary-Treasurer: E. J. Budden
122 12th St., Rockford, Ill.

Meeting Place: Faust Hotel, Rockford, Ill.

Day of Month: Second Monday
Time: 7:00 P.M.

Sustaining Members:
Illinois Water Treatment Co., Rockford, Illinois
National Lock Co., Rockford, Ill.

SAGINAW VALLEY

Secretary-Treasurer: John Krato
413 N. Grand Traverse, Flint 3, Mich.

Meeting Place: Zehnder, Frankenmuth, Michigan

Day of Month: Second Wednesday
Time: 6:45 P.M.

Sustaining Members:
American Buff Co., Chicago 16, Illinois

ST. JOSEPH VALLEY

Secretary: Henry A. Meers
1846 No. Wilber St., South Bend 28, Ind.

Meeting Place: Lincoln Highway Inn, Mishawaka, Ind.

Day of Month: First Wednesday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Members:
Bendix Aviation Corp., Bendix Prods. Div. South Bend 20, Ind.
Inland Chemical Corporation, Fort Wayne, Ind.
Leco Plating Co., St. Joseph, Mich.
Rockwell-Standard Corp., Mishawaka, Ind.
Roth Plating Corporation, South Bend, Ind.
South Side Plating Works, Inc., Elkhart, Ind.
Standard Plating Works, Inc., Goshen, Ind.
The Studebaker-Packard Corp., South Bend, Ind.

ST. LOUIS

Secretary: Ward W. Kelly
7046 Deerpath Drive, St. Louis 23, Mo.

Meeting Place: York Hotel, Sixth St. & Market St. St. Louis, Missouri

Day of Month: Second Wednesday
Time: Dinner 6:30 P.M.—Meeting 8:00 P.M.

Sustaining Members:
American Zinc Sales Co., St. Louis, Mo.
Bussman Mfg. Co., St. Louis, Mo.
Chandeysson Electric Co., St. Louis, Mo.
Davies Supply & Mfg. Co., St. Louis 16, Mo.
C. Hager & Sons Hinge Mfg. Co., St. Louis 5, Mo.
Knapp-Monarch Co., St. Louis 16, Mo.
Lasalco, Inc., St. Louis 4, Mo.
National Rejectors, Inc., St. Louis 15, Mo.
G. S. Robins Co., St. Louis 2, Mo.
Sommers Brothers Mfg. Co., St. Louis 7, Mo.

SAN DIEGO

Secretary: Walt Dornbusch
Brown Chemical Co., 1745 Imperial Ave., San Diego, Calif.

Meeting Place: Calabrese's Restaurant, Pacific Hwy., San Diego

Day of Month: Tuesday preceeding 2nd Wednesday
Time: Dinner 7:00 P.M.—Meeting—8:00 P.M.

SAN FRANCISCO

Secretary-Treasurer: C. E. Snelgrove
c/o Dynatex Corporation, 727 Shasta St., Redwood City, Calif.

Meeting Place: International Inn, South San Francisco, Calif.

Day of Month: Second Thursday
Time: 7:30 P.M.

Sustaining Members:
Schlage Lock Co., San Francisco 19, Calif.
Wildberg Bros. Smelting & Refining Co., South San Francisco, Calif.

SEATTLE-PUGET SOUND

Secretary: Mrs. Helen Archibald
17814 Palatine, Seattle, Wash.

Meeting Place: Andy's Diner, Seattle, Wash.

Day of Month: Third Tuesday (Flexible)
Time: 7:00 P.M.—Meeting 8:00 P.M.

Sustaining Members:
Kaiser Aluminum & Chemical Corp. Spokane, Wash

SOUTHEASTERN

Secretary-Treasurer: H. R. Stogner Sr.
2631 Tilson Road, Decatur, Georgia

Meeting Place: Architect & Engineers Bldg., 230 Spring St., Atlanta, Ga.

Day of Month: Second Friday
Time: 7:30 P.M.

Sustaining Member:
Production Plating Company, Adel, Ga.

SOUTHERN TIER

Secretary: John J. Bunsic
19 Duane Ave., Binghamton, N. Y.

Meeting Place: Carlton Hotel, Binghamton, N. Y., and Pierce's Restaurant, Elmira, N.Y.

Day of Month: Third Tuesday
Time: 7:15 P.M.

Sustaining Members:
International Business Machines Corp., Endicott, N. Y.

SPRINGFIELD

Secretary: Henry L. Heissfeld
74 Chilson St., Springfield, Mass.

Meeting Place: Wayside Restaurant, Riverdale Road, W. Springfield, Mass.

Day of Month: Fourth Monday
Time: Dinner 7:00 P.M.—Technical Session 8:00 P.M.

Sustaining Members:
The Chemical Corporation, Springfield, Mass.
Moore Drop Forging Co., Springfield, Mass.

SYDNEY

Secretary-Treasurer: M. R. MacKinnon
3 Hyde Brae St., West Strathfield, New South Wales, Australia

Meeting Place: Lecture Room, Sydney Technical College, Harris St., Ultimo, Sydney

Day of Month: Second Wednesday
Time: 7:30 P.M.

Sustaining Members:
None

SYRACUSE

Secretary: Edward Hall
West Monroe, N. Y.

Meeting Place: Turn Hall, 619 N. Salina St., Syracuse, N. Y.

Day of Month: Third Monday
Time: Dinner 6:45 P.M.—Meeting 8:00 P.M.

Sustaining Members:
Oneida, Ltd., Oneida, N. Y.

Special Contributions to Research Fund, (1960-1961): American Society for Testing Materials. Foreign Sustaining Members: Ingalco S. R. L. Co., Buenos Aires, Argentina.

TOLEDO

Secretary-Treasurer: Ben Gomersall
6015 Anthony Wayne Trail, Route 1, Maumee, Ohio

Meeting Place: Angelo's Spaghetti House, Stickney Ave., Toledo, Ohio

Day of Month: Firs Thursday
Time: Dinner 7:00 P.M.—Meeting 8:00 P.M.

Sustaining Member:
The Electric Auto-Lite Co. (2), Sharonville 8, Ohio

TORONTO

Secretary: John C. Harden
1138 Bridge Rd., Oakville, Ontario, Canada

Meeting Place: Royal York Hotel, Toronto, Ontario, Canada

Day of Month: Second Friday
Time: Dinner 6:30 P.M.—Meeting 8:15 P.M.

Sustaining Members:
Armalite Company, Ltd., Toronto, Ontario, Canada
Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ontario, Canada
Canadian Motor Lamp Company Ltd., Windsor, Ontario, Canada
The de Havilland Aircraft of Canada, Ltd., Downsview, Ontario, Canada
Houdaille Industries of Canada, Ltd., Oshawa, Ontario, Canada
International Business Machines Co., Toronto 6, Ontario, Canada
International Nickel Co. of Canada, Ltd., (3) Toronto, Ontario, Canada
Lea Manufacturing Co. of Canada, Ltd., Scarborough, Ontario, Canada
M. & T. Products of Canada, Limited., Rexdale, Ontario, Canada
Sunbeam Corp. (Canada) Ltd., Toronto 18, Ontario, Canada
W. W. Wells, Ltd., Scarborough, Ontario, Canada

WATERBURY

Secretary-Treasurer: James R. Kennedy
74 Bidwell St., Waterbury, Conn.

Meeting Place: Colonial Room, Roger Smith-Elton Hotel

Day of Month: Second Thursday
Time: Dinner 6:30 P.M.—Meeting 8:30 P.M.

Sustaining Members:
Allied Control Company, Inc., Plantsville, Conn.
American Brass Company, Waterbury 20, Conn.
American Chemical & Refining Co., Waterbury, Conn.
Apothecaries-Hall Co., Waterbury, Conn.
Chromium Corporation of America, New York, N. Y.
The International Silver Co., Meriden, Conn.
The Lea Mfg Co., Waterbury 20, Conn.
Lux Clock Manufacturing Co., Waterbury, Conn
MacDermid, Inc., Waterbury 20, Conn.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
The Summit Finishing Co., Inc., Thomaston, Conn.
Wallace Silversmiths, Inc., Wallingford, Conn.
The Waterbury Plating Co., Waterbury 86, Conn.
Whyco Chromium Co., Inc., Thomaston, Conn.

WESTERN ONTARIO

Secretary-Treasurer: John Howard Marshall
119 Blake St., Wallaceburg, Ontario, Canada

Meeting Place: William Pitt Hotel, Chatham, Ontario, Canada

Day of Month: Third Friday
Time: 6:30 P.M.—Dinner-Meeting

Sustaining Members:
Bendix Eclipse of Canada, Ltd., Windsor, Ontario, Canada
General Motors of Canada, Ltd., Oshawa, Ontario, Canada
Ontario Steel Products Co., Ltd., Chatham, Ontario, Canada

WICHITA

Secretary: Edward Seiwert
533 Prosperity Lane, Wichita, Kansas

Meeting Place: Oriental Restaurant, 5405 E. Central, Wichita, Kas.

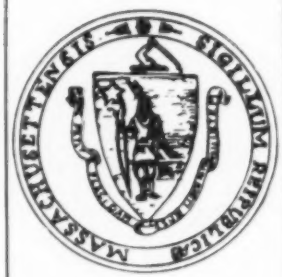
Day of Month: Fourth Wednesday
Time: 6:30 P.M.

Sustaining Members:
Boeing Airplane Co., Wichita Div., Wichita, Kansas

NEW ENGLAND BRANCHES
OF
AMERICAN ELECTROPLATERS' SOCIETY, INC.

BRIDGEPORT (CONN.) BRANCH
FOUNDED 1914
WILLIAM HYATT JR.
PRESIDENT

BOSTON (MASS.) BRANCH
FOUNDED 1921
HUBERT H. FOLEY
PRESIDENT



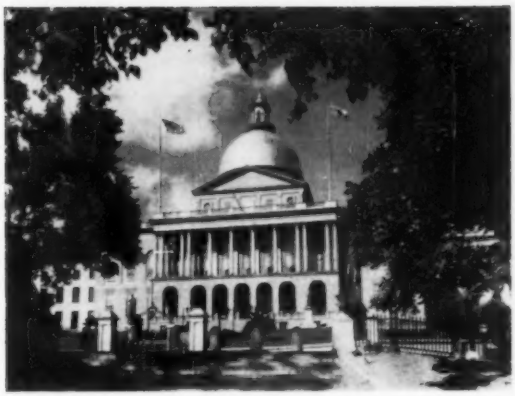
HARTFORD (CONN.) BRANCH
FOUNDED 1921
WALTER J. DYBER
PRESIDENT

NEW HAVEN (CONN.) BRANCH
FOUNDED 1938
HARRY R. TAYLOR
PRESIDENT

SPRINGFIELD (MASS.) BRANCH
FOUNDED 1936
ALEXANDER R. SALMOND
PRESIDENT

WATERBURY (CONN.) BRANCH
FOUNDED 1921
WILLIAM C. GIESKER
PRESIDENT

PROVIDENCE-ATTLEBORO (R.I.) BRANCH
FOUNDED 1916
DANIEL TURNER
PRESIDENT



"AMERICAN ELECTROPLATERS' SOCIETY WEEK IN BOSTON"

TO THE community once known as "Shawmut," American Electroplaters' Society, Inc. (AES) will bring its farflung membership to conduct there, its 48th Annual Convention, June 18-23, 1961. In that community now renowned by its more modern name, Boston, that entire week has been publicly declared by its Mayor John F. Collins as "American Electroplaters' Society Week in Boston." The City and the Society deserve each other.

In the unsettled wilderness that was today's New England in 1630, that community was conceived and developed by a hardy, courageous chartered company of English Puritans, mainly stemming from a town in Lancashire, England, named Boston, first as "Shawmut," then as "Trimountaine." Under its storied Governor John Winthrop, it assumed its Boston cognomen later in 1630—became the capital of the Massachusetts Bay Colony in 1632—then swept through the vicissitudes of American history to its present status and stature as capital of our nation's eminent Commonwealth of Massachusetts.

FROM quaint Boston's early leadership in trade and commerce and as a great port, grew Boston's greatness of today as an industrial center. It was here that the first blood of the American Revolution was shed—the first public school opened—the first newspaper published—the first railway and subway built—the first airline route launched —the world's first telephone call made—the first ether operation performed—sic ad infinitum.

From textiles, Boston shifted to machinery and small parts manufacturing—became a leading financial and banking center—became the educational, medical and research center of the Americas. As a dynamic metropolis, it was only natural that it should house a dynamic Branch of American Electroplaters' Society, Inc.

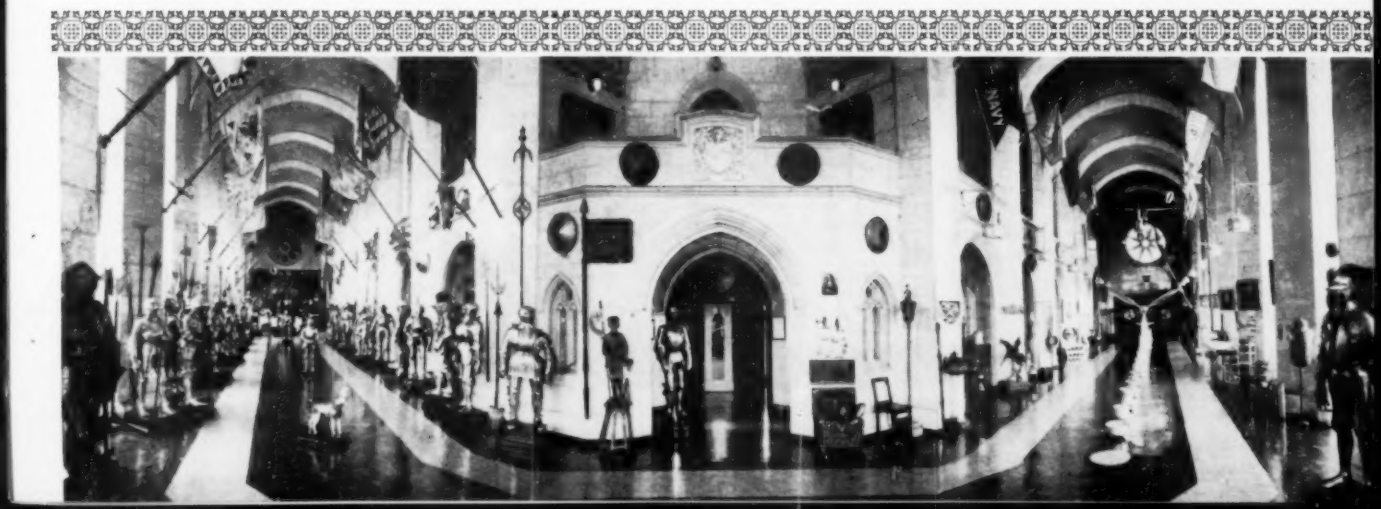
WITH the creation of AES's Boston Branch in the Bay City two score years ago, that municipality and AES forged a community relationship that has galvanized as advancements in the arts and sciences of electroplating, metal finishing and allied arts made greater and greater progress in that New England area.

Since coming of age as one of the largest and most respected Branches of the Society, the Boston Branch has, on two prior occasions, served creditably as host of an AES National Convention, and is now confidently ready to make its third such effort even more outstanding.

Bostontown of Massachusetts and Boston Branch of AES deserve each other indeed!

♦

Among the abundance of interesting sights to behold in or near Boston is the Steel Museum in Worcester, Mass. Below, its "Ancient Wing."



THE COMMONWEALTH OF MASSACHUSETTS

EXECUTIVE DEPARTMENT

STATE HOUSE, BOSTON

JOHN A. VOLPE
Governor

March 27, 1961

TO THE MEMBERS OF THE AMERICAN
ELECTROPLATERS' SOCIETY, INC.:

It is a pleasure for me as Governor of Massachusetts, to extend the welcome of the Commonwealth to the 48th Annual Convention of the American Electroplaters' Society, Inc. I would also like to congratulate the Boston Branch, host to the Convention, on its 40th Anniversary.

In the more than half-century of its existence, the Society's membership has become world-wide. Here in America, AES members are employed throughout the automotive, aircraft, electrical, electronics and other industries engaged in metal finishing.

Every individual of the United States comes into contact every day with the multitude of products that have been developed or produced by them, from missiles and aircraft and automobiles to fountain pens, safety pins and other common household products.

The research program, outstanding among the Society's educational projects, is particularly commendable. It sponsors and finances research on specific phases of plating and metal finishing at various American and Canadian universities and foundations.

To the many members of the Society, to all the delegates and their families, especially those who are here for the first time, I wish to express the best wishes of the Commonwealth for a successful convention and a pleasant visit.

Sincerely,

John A. Volpe

Governor

CITY OF BOSTON
OFFICE OF THE MAYOR
CITY HALL

JOHN F. COLLINS
Mayor

DECLARATION

WHEREAS, the American Electroplaters' Society, Inc. will hold its 48th Annual Convention in Boston; and

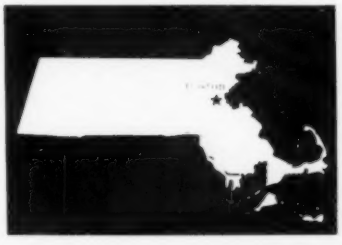
WHEREAS, this Society was created more than a half-century ago for the purpose of fostering technical and scientific knowledge and advancements in electroplating, metal finishing and allied arts; and

WHEREAS, the American Electroplaters' Society (AES) today enjoys a global membership, including many members who are residents of communities in our Commonwealth,

NOW, THEREFORE, I, John F. Collins, Mayor of Boston, do hereby declare the week of June 18-23, 1961 as

"AMERICAN ELECTROPLATERS' WEEK"

John F. Collins
Mayor of Boston



PROGRAM
FORTY-EIGHTH ANNUAL CONVENTION
AMERICAN ELECTROPLATERS' SOCIETY, INC.
STATLER-HILTON HOTEL, BOSTON, MASSACHUSETTS, JUNE 18-23, 1961

SUNDAY, JUNE 18

9:00 a. m.	Executive Board Meeting (All Day)	AES Headquarters Room
1:00–8:00 p. m.	Registration	Mezzanine
2:00 p. m.	Honorary Membership Award Committee Meeting	Room 418
2:00 p. m.	AES Scientific Achievement Award Committee Meeting	Room 410
3:00 p. m.	Ladies Program Tea of Welcome	Veranda
4:00 p. m.	Credentials Committee Meeting with Executive Board	Headquarters Room
8:00 p. m.	AES Get-Together Party	Grand Ballroom

MONDAY, JUNE 19

8:00 a. m.-9:00 p. m.	Registration	Mezzanine
9:30 a. m.	Children's Program (Tour of Salem-Marblehead Area, including Luncheon)	Buses from Statler Hotel
10:00 a. m.	Grand Opening Session	Grand Ballroom

Invocation — Leonard A. Chesworth, Boston Branch
Keynote Address — Simon D. Strauss, Vice President, American Smelting and Refining Co.; Vice President, Lead Industries Association; Past President, American Zinc Institute.

11:00 a. m.	Business Meeting Supreme Society	Grand Ballroom
12:00 noon	Branch Secretaries' Luncheon	Parlor A
12:15 p. m.	Speakers' Luncheon	Parlor B
12:30 p. m.	Ladies Luncheon, *Sponsored by The Udylite Corporation*	Ballroom Assembly
1:00 p. m.	Plant Visit. Keystone Camera Co.	Buses from Statler Hotel
1:00 p. m.	Plant Visit. Boston Globe	Buses from Statler Hotel
2:00 p. m.	Opening Educational Session (The William Blum Lecture)	Grand Ballroom

"The Challenge Before Us" by Dr. Charles L. Faust

2:30 p. m.	Editorial Board Meeting	Parlor C
2:30 p. m.	Publications Committee Meeting	Room 437
2:30 p. m.	Educational Session A (Research)	Grand Ballroom

1. "The AES Research Program" by Dr. D. Gardner Foulke, Sel-Rex Corp.
2. AES Research Project No. 15—"Progress Report on the Development of Corrosion Tests for the Performance of Plated Coatings" by Walter L. Pinner, McGean Chemical Co.
3. AES Research Project No. 14—"A Microscopic Study of Chromium Plating" by M. H. Jones and J. Saiddington, Ontario Research Foundation

2:30 p. m.	Educational Session B (Organic Finishing)	Georgian Room

4. "Functional Vinyls Go Decorative" by Fremont L. Scott and Hyman Metz, Metal & Thermit Corp.
5. "Experience-Proven Epoxy-Acrylic Finish System" by Robert F. Howard, Bell Helicopter Co.

4:00 p. m.	Order of Past Presidents Meeting	Hancock Room
6:00 p. m.	Order of Past Presidents Dinner	Hancock Room
8:00 p. m.	MFSA Ball	Grand Ballroom

(Admittance by AES Convention Registration Badge)

TUESDAY, JUNE 20

8:00 a. m.	Charles Henry Proctor Memorial Leadership Award Selection Committee Breakfast	Room 418
8:00 a. m.	Speakers' Breakfast	Parlor C
9:00 a. m.-5:30 p. m.	Registration	Mezzanine
9:00 a. m.	Educational Session C (Finishing of Light Metals Symposium)	Grand Ballroom

6. "Nickel-Chromium Plating Upon Anodized Aluminum" by H. J. Wittrock, Kaiser Aluminum & Chemical Corp.
7. "Conversion Coating of Aluminum Alloys" by Dr. J. F. Murphy, Metallurgical Laboratories, Olin Mathieson Chemical Corp.
8. "Outdoor Exposure of Anodic Coatings on Aluminum: Effect of Sealing" by Dr. R. C. Spooner, Aluminium Laboratories Ltd.
9. "Effect of Voltage During Anodizing of Aluminum" by W. C. Cochran and F. Keller, Alcoa Research Laboratories, Aluminum Company of America

9:00 a. m.	Membership Committee Meeting	Room 436
9:00 a. m.	Public Relations Committee Meeting	Room 438
9:00 a. m.	Educational Committee Meeting	Room 440
9:00 a. m.	Plant Visit. Gillette Safety Razor Co. (1st group)	Buses from Statler Hotel
9:00 a. m.	Children's Program (Tour of Boston and Cambridge. Lunch at Smith House)	Buses from Statler Hotel
9:30 a. m.	Ladies Program (Scenic Tour of North Shore enroute to Ipswich)	Buses from Statler Hotel
12:00 noon	Joint Educational Committee and Branch Librarians Luncheon	Parlor A
12:00 noon	Speakers' Luncheon	Parlor C
12:00 noon	Ladies Luncheon (Castle Hill, Crane Estate, Ipswich, Mass.) *Sponsored by M. E. Baker Company, The Lea Manufacturing Company and Lea-Ronal, Inc.*	Buses 9 a. m. from Statler Hotel
1:00 p. m.	Plant Visit. Gillette Safety Razor Co. (2nd group)	Buses from Statler Hotel
2:00 p. m.	Educational Session D (Finishing of Light Metals Symposium)	Grand Ballroom

10. "Plating on Magnesium by Electrodeposition and Chemical Reduction Methods" by H. K. DeLong, Dow Metal Products Company, Division of the Dow Chemical Co.

TUESDAY, JUNE 20 (continued)

11. "Anodic Treatments for Magnesium" by J. S. Kirkpatrick, Brooks and Perkins, Inc.
12. "Chromic Acid Anodizing of Beryllium: Process Parameters" by L. Whitby, E. Gowen and D. J. Levy, Lockheed Aircraft Corp.
13. "Chromic Acid Anodizing of Beryllium: Process Development" by Leo Missel, Lockheed Aircraft Corp.

2:00 p. m. **AES Midwest Regional Council Meeting** **434**
2:00 p. m. **Southwestern Regional Council Meeting** **436**
4:00 p. m. **AES Regional Group and Council Chairmen's Meeting** ..... **Room 442**
4:30 p. m. **Finishing of Light Metals Forum** ..... **Grand Ballroom**
8:30 p. m. **"Fun with Fiedler" at Boston Pops** ..... **Boston Symphony Hall**

WEDNESDAY, JUNE 21

8:00 a. m. **Research Committee Breakfast** ..... **Parlor A**
8:00 a. m. **Speakers' Breakfast** ..... **Parlor B**
9:00 a. m.–12:00 noon **Registration** ..... **Mezzanine**
9:00 a. m. **Educational Session E** ..... **Grand Ballroom**

14. "Quality Control Study to Determine Optimum Conditions for Barrel Plating in Zinc Cyanide Solutions" by Dr. Russel E. Harr, Western Electric Company
15. "The Practical Application of Statistics to the Quality Control of Electroplated Products" by James J. Glass and James K. Gore, Los Alamos Scientific Laboratory
16. "Objectives in Corrosion Protection of Bright Decorative Trim and Their Implementation" by John McDougall, Ford Motor Co.

9:00 a. m. **Educational Session F** ..... **Georgian Room**

17. "The Anodic Behavior of Metals in Cleaning Media—Copper and Its Alloys" by Samuel S. Frey, Oakite Products, Inc.
18. "Improved Adhesion of Electroless Nickel Plate on Titanium Alloys" by Milton Levy and John B. Romolo, Watertown Arsenal Laboratories

9:00 a. m. **Research Committee Meeting** ..... **Parlor C**
1:30 p. m. **AES Annual Outing (Clambake at Historic Plymouth, Mass.)** ..... **Buses from Statler Hotel**

THURSDAY, JUNE 22

8:00 a. m. **Speakers' Breakfast** ..... **Hancock Room**
9:00 a. m. **Business Meeting, Supreme Society** ..... **Parlors A, B, C**
9:00 a. m. **Educational Session G** ..... **Grand Ballroom**

19. "Precious Metal Plating and Solderability" by A. Korbelak and R. Duva, Sel-Rex Corp.
20. "Vapor Deposition of Aluminum by Thermal Decomposition" by Edgar H. Maus Sr., Queen City Steel Treating Company
21. "Stoichiometry of Copper Bonding Using Copper Oxide" by Edward B. Murphy and Thomas P. Turnbull, Massachusetts Institute of Technology, Lincoln Laboratory

9:00 a. m. **Educational Session H** ..... **Georgian Room**

22. "Corrosion—Current Data for Nickel-Chromium Couples" by W. H. Safranek, H. R. Miller and R. W. Hardy, Battelle Memorial Institute
23. "Electroplating of Zinc-Base Die Castings in a System Incorporating Dual Chromium" by James H. Lindsay, W. E. Lovell, Ternstedt Division of General Motors Corp., and D. W. Hardesty, General Motors Corp. Research Laboratories

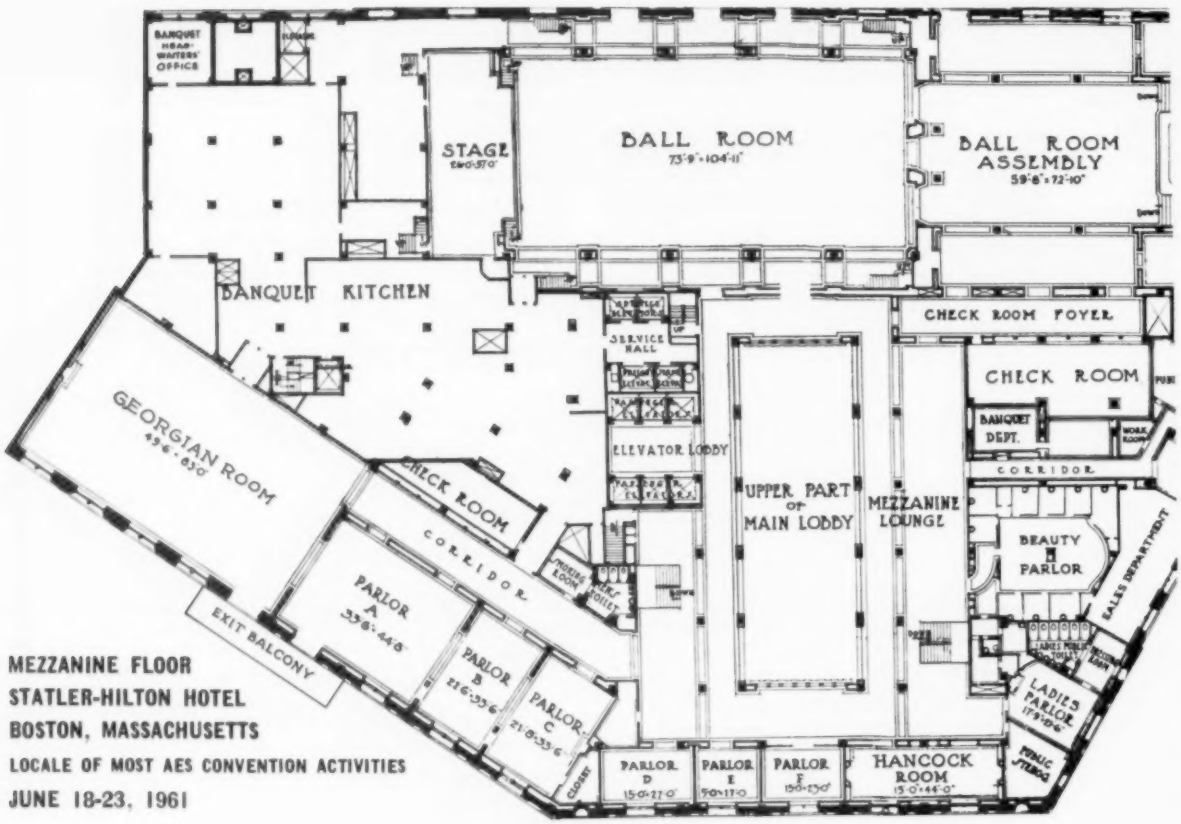
9:00 a. m. **Plant Visits. Western Electric Company, North Andover, luncheon at Western Electric plant, afternoon visit at Raytheon Mfg. Co., Andover** ..... **Buses from Statler Hotel**
9:30 a. m. **Ladies Program: Tour of Historic Boston** ..... **Buses from Statler Hotel**
9:30 a. m. **Children's Program (Tour of Museum of Science and Planetarium, followed by Boat ride on the Charles River)** ..... **Buses from Statler Hotel**
12:00 noon **Speakers' Luncheon** ..... **Hancock Room**
12:30 p. m. **Ladies Luncheon at John Hancock Building, *Sponsored by Sel-Rex Corporation*** **(Followed by talk "Gold and Man," illustrated by Oil Paintings)** ..... **Dorothy Quincy Suite**
2:00 p. m. **Business Meeting, Supreme Society** ..... **Parlors A, B, C**
2:00 p. m. **Educational Session I** ..... **Grand Ballroom**

24. "Plating of Printed Circuits with Pyrophosphate Copper and Tin-Nickel" by R. W. Couch and R. G. Bikales, Metal & Thermit Corp.
25. "Evaluation of Solderability of Electroplated Coatings" by L. K. Bjelland and J. M. Thompson, Convair-Pomona, A Division of General Dynamics Corp.
26. "Producing Ultra-High Frequency Electronic Parts by Electroless Copper and Precious Metal Plating on Plastics" by Charles E. MacNeill, The Martin Company

6:00 p. m. **MFSA Cocktail Party** ..... **Georgian Room & Parlors A, B, C**
(Admittance by AES Convention Registration Badge)
7:00 p. m. **AES Farewell Banquet** ..... **Grand Ballroom**

FRIDAY, JUNE 23

8:00 a. m. **President's Breakfast to National Officers and their Families** ..... **Parlor C**
9:00 a. m. **Executive Board Meeting** ..... **AES Headquarters Room**



MEZZANINE FLOOR
STATLER-HILTON HOTEL
BOSTON, MASSACHUSETTS
LOCALE OF MOST AES CONVENTION ACTIVITIES
JUNE 18-23, 1961

BEFORE THE SUPREME SOCIETY

AGENDA
FIRST BUSINESS SESSION

GRAND BALLROOM
STATLER-HILTON HOTEL,
BOSTON, MASSACHUSETTS
MONDAY MORNING, JUNE 19, 1961

I Call to Order, ANNUAL MEETING.
II Roll Call of Officers.
III Report of Credentials Committee.
IV Roll Call of Delegates.
V In Memoriam.
VI Reports of Officers (Published Copies in DELEGATES KITS):
- (a) President
- (b) First Vice President
- (c) Second Vice President
- (d) Third Vice President
- (e) Past President
- (f) Executive Secretary

VII Reports of Standing and Special Committees (Copies in DELEGATES KITS).
VIII Report on New Branches.
IX 1960-1961 Financial Statement and 1961-1962 Budget (Copies in DELEGATES KITS).
X Report of Paper Awards Committee and Presentation of Awards.
XI Announcement of Board Appointments To:
- (a) Editorial Board
- (b) Research Committee
- (c) Public Relations Committee
- (d) Election Committee
- (e) Honorary Membership Awards Committee
- (f) Educational Committee
- (g) Membership Committee
- (h) Publications Committee
- (i) Scientific Achievement Award Committee

XII Presentation, Proposed Revisions, Constitution and Bylaws.
XIII Business Brought for Discussion by Delegates.
XIV Recess of ANNUAL MEETING.

AGENDA
SECOND BUSINESS SESSION

PARLORS A–B–C, STATLER-HILTON HOTEL, BOSTON

THURSDAY, JUNE 22, 1961

I Call to Order, ANNUAL MEETING.
II Roll Call of Officers.
III Roll Call of Delegates.
IV Roll Call of Living Past Presidents.
V Financial Statement (1960-1961) and Proposed Operating Budget (1961-1962):
- (a) Action on Proposed Operating Budget for the 1961-1962 Fiscal Year (July 1-June 30)

VI Action on AES Constitutional and Bylaw Amendments Proposed by the Executive Board
- (a) Increasing the Rate of the Society's Per Capita Tax, Member-at-Large Dues and Minimum Branch Dues, Effective July 1, 1962
- (b) Requiring Per Capita Tax Payment by Branches for New Members Starting With the Quarter During Which Elected
- (c) Altering the Branch Title "Librarian" to "Educational Chairman"
- (d) Broadening the Function of the Publications Committee

VII Report on Membership Competition. Presentation of Branch Awards.
VIII Action on Nominees for AES Honorary Membership.
IX Announcement of Award of Merit Winners.
X Presentation of "Order of Past Presidents Award," if Any.
XI Business Brought for Discussion by Delegates.
XII Discharge of 1960-1961 Special Committees.
XIII Nomination and Election of 1961-1962 Officers:
- (a) President
- (b) First Vice President
- (c) Second Vice President
- (d) Third Vice President

XIV Installation Ceremony:
- (a) Installation of Newly Elected Officers
- (b) Presentation of Gavel to New President
- (c) Presentation of Plaque and Past President's Pin to Retiring President

XV Report by Boston Convention General Chairman.
XVI Reports by Future Convention Chairmen (Milwaukee, Atlantic City, St. Louis, New York, Miami).
XVII Report of Ninth Interim Meeting (1962) Chairman.
XVIII Selection of Convention City of AES's Fifty-Fourth Annual Convention (1967).
XIX Selection of Site and Date of Tenth Interim Meeting (1963).
XX Resolution of Thanks to Boston Branch.
XXI Adjournment of ANNUAL MEETING.

AES BOARD AND COMMITTEE MEETINGS AT 48th ANNUAL CONVENTION, AMERICAN ELECTROPLATERS' SOCIETY • STATLER-HILTON HOTEL • BOSTON, MASSACHUSETTS

SUNDAY, JUNE 18

		Room	Presiding
9 a.m.	Executive Board	Hq. Room	Dr. W. A. Wesley
2 p.m.	Honorary Membership Award Committee	418	Dr. S. Heiman
2 p.m.	AES Scientific Achievement Award Committee	410	William M. Tucker
4 p.m.	Credentials Committee	Hq. Room	Robert L. Garrett

MONDAY, JUNE 19

		Room	Presiding
12 noon	Branch Secretaries	Parlor A	John P. Nichols
2:30 p.m.	Editorial Board	Parlor C	John P. Nichols
2:30 p.m.	Publications Committee	437	Dr. S. Heiman
4 p.m.	Order of Past Presidents	Hancock	S. S. Johnston

TUESDAY, JUNE 20

		Room	Presiding
8 a.m.	Proctor Award Selection Committee	418	Dr. W. A. Wesley
9 a.m.	Educational Committee	440	Ralph H. McCahan
9 a.m.	Membership Committee	436	John J. Bunsic
9 a.m.	Public Relations Committee	438	Arthur G. Pierdon
12 noon	Branch Librarians and Educational Committee	Parlor A	Chester G. Borlet
2 p.m.	Midwest Regional Council	434	Leslie L. Diveley
2 p.m.	Southwest Regional Council	436	Myron E. Browning
4 p.m.	Regional Council Chairmen	442	John P. Nichols

WEDNESDAY, JUNE 21

		Room	Presiding
8 a.m.	Research Committee Breakfast	Parlor A	Dr. D. G. Foulke
9 a.m.	Research Committee Meeting	Parlor C	Dr. D. G. Foulke

FRIDAY, JUNE 23

		Room	Presiding
9 a.m.	Executive Board	Hq. Room	Chester G. Borlet

EDUCATIONAL SESSIONS CHAIRMEN
AES 48th ANNUAL CONVENTION
BOSTON, MASSACHUSETTS

OPENING SESSION

Dr. William Blum

SESSION A

James D. Thomas

SESSION B

Manson Glover

SESSION C

Dr. Gerald H. Kissin

SESSION D

Charles Levy

SESSION E

Dr. George P. Swift

SESSION F

Hubert H. Foley

SESSION G

William P. Innes

SESSION H

Dr. M. M. Beckwith

SESSION I

Dr. Harold Narcus

PROGRAM

EDUCATIONAL SESSIONS

48th ANNUAL CONVENTION • AMERICAN ELECTROPLATERS' SOCIETY, INC.

STATLER-HILTON HOTEL, BOSTON, MASSACHUSETTS

JUNE 19-22, 1961

MONDAY, JUNE 19
2:00 p.m. ..... Grand Ballroom

Session Chairman—*Dr. William Blum, Consultant*

THE THIRD ANNUAL "WILLIAM BLUM LECTURE"—THE CHALLENGE BEFORE US

by Dr. Charles L. Faust, Battelle Memorial Institute

Research has been the key to progress in the processes used by members of and industries associated with the AES. Greatly improved performance can be attained by electroplates both as coatings and as electroforms. Efforts mainly have been process oriented. The time is here for greater emphasis on product orientation, on consideration of electroplates as materials, and on electrodepositing quality into electroplates instead of devising ways to inspect quality into them. The challenge is to take these steps by instituting the necessary actions.

MONDAY, JUNE 19
2:30 p.m. ..... Grand Ballroom

SESSION A

Session Chairman—*James D. Thomas, General Motors Corporation*

THE AES RESEARCH PROGRAM

by D. Gardner Foulke, 1960-1961 Chairman, AES Research Committee

The origin and philosophy of the AES Research Program are discussed. Accomplishments in the past year are reviewed. Questions are raised as to the future of the AES Research Program and a plea is made for each AES member to acquaint himself with the program. Finally, recommendations are presented based upon the ever-increasing importance of research in a changing world where the only thing that does not change is change itself.

AES RESEARCH PROJECT NO. 15—PROGRESS REPORT ON THE DEVELOPMENT OF CORROSION TESTS FOR THE PERFORMANCE OF PLATED COATINGS

by Walter L. Pinner, McGean Chemical Co., Project Chairman

This report on AES Project 15 sets forth in detail the latest committee-approved procedures for conducting the CASS and Corrodkote Tests. The present status of the Project is summarized and the future aims of the Project Committee are stated. The adaptability of the CASS and Corrodkote Tests to finishing systems other than copper and/or nickel-chromium coatings on steel and zinc alloy basis metals is discussed. Information correlating the corrosion test results with service data is presented.

AES RESEARCH PROJECT NO. 14—A MICROSCOPIC STUDY OF CHROMIUM PLATING

by M. H. Jones and J. Saiddington, Ontario Research Foundation

An apparatus is described for the direct microscopic observation of the deposition of chromium on nickel and other basis metal surfaces. The study has provided information on the initial nucleation pattern, the development of cracking in chromium deposits and the associated hydrogen gas evolution for various plating conditions. The work constitutes an extension of the preliminary investigation of Brittain and Smith and the microscopic observations are considered in relation to the mechanism of chromium deposition.

Dr. Charles L. Faust

Dr. D. G. Foulke

Walter L. Pinner

Dr. M. H. Jones

J. Saiddington

Fremont L. Scott

Hyman Metz

Robert F. Howard

H. J. Wittrock

Dr. J. F. Murphy

MONDAY, JUNE 19

2:30 p.m. ..... Georgian Room

SESSION B

Session Chairman—*Manson Glover, Glover Coating Co., Inc.*

FUNCTIONAL VINYLS GO DECORATIVE

by Fremont L. Scott and Hyman Metz, Metal & Thermit Corporation

The spray application of vinyls as decorative finishes for consumer and industrial products is presented. The properties—corrosion resistance, toughness, resiliency—of plastisols already well known in their functional uses in the electroplating industry are maintained by the organosol technique used to produce attractive decorative finishes. Advantages of the spray-on organosols over the vinyl laminate and pre-coated vinyl sheet are outlined and demonstrated. Case histories on the use of spray-on organosols in the appliance, data processing equipment and automotive fields are covered in detail.

EXPERIENCE-PROVEN EPOXY-ACRYLIC FINISH SYSTEM

by Robert F. Howard, Bell Helicopter Co.

A new finishing system in aircraft, automotive and related fields is presented. Two years of service experience have been completed with this finish system which utilizes the inherent properties of catalyzed epoxies and acrylics. This involves a paint finish setting at room temperature that combines the tenacious adhesion, chemical resistance, and toughness of epoxies, with the excellent resistance to outdoor weathering, diester oil resistance, and attractiveness of acrylics

TUESDAY, JUNE 20

9:00 a.m. ..... Grand Ballroom

SESSION C

Session Chairman—*Dr. G. H. Kissin, Kaiser Aluminum & Chemical Corporation*

NICKEL-CHROMIUM PLATING UPON ANODIZED ALUMINUM

by H. J. Wittrock, Kaiser Aluminum & Chemical Corporation

Nickel-chromium plating upon anodized aluminum is a means of producing a bright corrosion-resistant finish. The method avoids the possibility of aggravated galvanic attack of the basis aluminum experienced when copper is part of the plated coating. The anodizing process for gaining nickel adhesion on various aluminum alloys is outlined and compared with other plating systems. Corrosion resistance in atmospheric and accelerated tests is comparable to that of similarly plated steel and is also benefited by plating techniques that enhance the integrity of the coating such as increasing plate thickness and plating with duplex nickel, crack-free chromium and duplex chromium.

CONVERSION COATING OF ALUMINUM ALLOYS

by J. F. Murphy, Metallurgical Laboratories, Olin Mathieson Chemical Corporation

A review is made of the purposes of oxide, phosphate and chromate coating of aluminum alloys and the phenomena upon which their usefulness is based. There is a brief discussion of the physical and chemical properties of the coatings which are related to corrosion resistance and adhesion. Emphasis is placed upon the relationship between corrosion resistance and chemical composition. The adhesion of organic films to conversion coatings is analyzed in terms of

W. C. Cochran

Fred Keller

Dr. Roy C. Spooner

J. S. Kirkpatrick

H. K. DeLong

Leo Missel

L. Whitby

D. S. Levy

Dr. Russel E. Harr

James K. Gore

James J. Glass

composition and structure. Finally, there is a discussion of the probable mechanisms involved in the conversion coating process, in order to provide some reasonable hypotheses of the relationship between the mechanism of formation, the properties of the coating, and their effectiveness in improving corrosion resistance and adhesion of organic materials.

OUTDOOR EXPOSURE OF ANODIC COATINGS ON ALUMINUM: EFFECT OF SEALING

by R. C. Spooner, Aluminium Laboratories Limited

The outdoor weathering behavior of sulfuric acid anodic coatings on aluminum alloys is discussed. Panels prepared by different procedures, including various anodizing conditions, a wide range of sealing treatments, and several overcoating techniques, were exposed outdoors in Canadian locations for periods up to 10 years. The nature of weathering attack is described for both bold and protected exposure conditions. Performance in laboratory tests and outdoor exposure is correlated with the various anodizing, sealing and coating procedures that were used.

EFFECT OF VOLTAGE DURING ANODIZING OF ALUMINUM

by W. C. Cochran and F. Keller, Alcoa Research Laboratories, Aluminum Company of America

The voltage employed during anodic treatment of aluminum alloys plays a major part in establishing several important characteristics of the oxide coatings produced. Such features as brightness, specularity and abrasion resistance of the anodic finish can vary widely depending on the forming voltage. This factor is influenced by the presence of various alloying elements in commercial aluminum alloys. Data are presented showing how the anodizing voltage influences the appearance of an anodic coating. Anodizing procedures for obtaining bright, decorative finishes with optimum image clarity are discussed.

TUESDAY, JUNE 20

2:00 p.m. ..... Grand Ballroom

SESSION D

Session Chairman—*Charles Levy, Gillette Safety Razor Co.*

PLATING ON MAGNESIUM BY ELECTRODEPOSITION AND CHEMICAL REDUCTION METHODS

by H. K. DeLong, Technical Service & Development Laboratory, Dow Metal Products Company, Division of the Dow Chemical Company

Recently there has been an increasing demand for plating on magnesium base alloys for electronic equipment in the aircraft and missile fields. Applications wherein combined good grounding, conductivity, solderability, and protection are a requisite are now being plated with final deposits of tin, nickel, silver, gold, platinum, etc. Also the increased use of these alloys in die cast form in the automotive field has prompted a demand for an effective and economical method of decorative chromium plating. Various methods of applying plated coatings to magnesium alloys are described along with some data on their relative corrosion performance in accelerated test environments. A new method is presented applying nickel on magnesium by chemical reduction.

ANODIC TREATMENTS FOR MAGNESIUM

by J. S. Kirkpatrick, Brooks and Perkins, Inc.

After a review of general finishing techniques for magnesium there will be an analysis of typical corrosion behavior of magnesium alloys. The various protective anodic treatments which are applicable to commercial magnesium alloys will be described and the important process parameters will be outlined, together with their effect upon the physical and chemical properties of the coatings produced. The use of anodic coatings in typical applications will be described.

John McDougall

Samuel S. Frey

Milton Levy

John B. Romolo

E. H. Maus Sr.

CHROMIC ACID ANODIZING OF BERYLLIUM: PROCESS PARAMETERS

by L. Whitby, E. Gowen and D. J. Levy, Missiles and Space Division, Lockheed Aircraft Corporation

Corrosion protective coatings are formed by anodizing beryllium in chromic acid producing adherent glossy-black coatings which are chiefly BeO. The films possess little porosity but have sufficient ionic permeability to permit growth. Film thickness is initially a linear function of current consumption but is independent of current density over a wide range. Film thickness also increases with chromic acid concentration up to 10 per cent beyond which it remains constant.

CHROMIC ACID ANODIZING OF BERYLLIUM: PROCESS DEVELOPMENT

by Leo Missel, Missiles and Space Division, Lockheed Aircraft Corporation

Practical methods of pre-anodic preparation and of chromic acid anodizing of beryllium are described. A jet black, glossy coating with excellent protective properties was obtained. Basis metal quality and its effects on the anodic coating are discussed.

WEDNESDAY, JUNE 21

9:00 a.m. ..... Grand Ballroom

SESSION E

Session Chairman—*Dr. George P. Swift, Consultant*

QUALITY CONTROL STUDY TO DETERMINE OPTIMUM CONDITIONS FOR BARREL PLATING IN ZINC CYANIDE SOLUTIONS

by Russel E. Harr, Western Electric Company

Variations in the distributions of plating thickness caused by changes of barrel rotational speed, current density, and some effects of solution composition were studied by quality control techniques. Abbreviated form of process capability studies was used for this investigation.

THE PRACTICAL APPLICATION OF STATISTICS TO THE QUALITY CONTROL OF ELECTROPLATED PRODUCTS

by James J. Glass and James K. Gore, Los Alamos Scientific Laboratory

A practical use of statistics in quality control is described. A system is presented that offers a simple and economic way for inspectors to classify production lots. An actual use of the plans is related in detail and the calculations are described. Results of the use of this method as an inspection tool are graphically shown and the usefulness of the system to the modern plater is demonstrated.

OBJECTIVES IN CORROSION PROTECTION OF BRIGHT DECORATIVE TRIM AND THEIR IMPLEMENTATION

by John McDougall, Ford Motor Company

The Ford Motor Company was not satisfied with the quality of bright decorative automotive trim. The program that was effected to improve the durability of plated steel stampings and zinc die castings, anodized aluminum, and stainless steel parts is discussed. By an analysis of extensive data obtained by field surveys, mobile tests, and accelerated laboratory tests, the corrective action required to obtain improved durability was determined.

Alexander Korbelak

R. Duva

William H. Safranek

Hugh R. Miller

Robert W. Hardy

Edward B. Murphy

Thomas P. Turnbull

James H. Lindsay

William E. Lovell

Donald W. Hardesty

WEDNESDAY, JUNE 21

9:00 a.m. ..... Georgian Room

SESSION F

Session Chairman—*Hubert H. Foley, Raytheon Manufacturing Co.*

THE ANODIC BEHAVIOR OF METALS IN CLEANING MEDIA—COPPER AND ITS ALLOYS

by Samuel S. Frey, Oakite Products, Inc.

The anodic behavior of buffed copper and brass specimens in several common alkaline media is discussed. A new experimental spot checking procedure for making such studies is detailed. Parameters studied include current density, time, and composition, concentration and temperature of the solution. The specimens are subsequently plated with bright nickel, and evaluated with respect to its appearance and adhesion.

IMPROVED ADHESION OF ELECTROLESS NICKEL PLATE ON TITANIUM ALLOYS

by Milton Levy and John B. Romolo, Watertown Arsenal Laboratories

Electroless nickel-phosphorus alloy plate was investigated as an anti-galling coating for titanium alloys. The alloy was deposited in a modified National Bureau of Standards alkaline bath. Adherence, abrasion and wear resistance were improved by heat treating at relatively high temperatures. Diffusion bonding with a minimum of beta transformation was detected by metallographic and X-ray diffraction studies. Resistance to wear and abrasion was correlated with structure, assessed metallographically.

THURSDAY, JUNE 22

9:00 a.m. ..... Grand Ballroom

SESSION G

Session Chairman—*William P. Innes, Mac Dermid, Inc.*

PRECIOUS METAL PLATING AND SOLDERABILITY

by A. Korbelak and R. Duva, Sel-Rex Corporation

Various precious metal electrodeposits are discussed in conjunction with solderability as the last step in electronics manufacture. The effects of thickness, impurities in the deposits and time-temperature conditions of various solders on solderability are given. Transistor, printed circuit and relay manufacture utilizing specific precious metal electroplates are detailed.

VAPOR DEPOSITION OF ALUMINUM BY THERMAL DECOMPOSITION

by Edgar H. Maus Sr., Queen City Steel Treating Company

Comparison of the thermal decomposition method versus the standard vacuum method, as well as engineering methods are discussed. A diagram of a typical facility is shown. Types of compounds for use in this method are presented. Deposition variables are given as are properties of coating-to-basis metal bonding.

STOICHIOMETRY OF COPPER BONDING USING COPPER OXIDE

by Edward B. Murphy and Thomas P. Turnbull, Massachusetts Institute of Technology, Lincoln Laboratory

A good physical bond and electrical connection can be achieved between a copper metal item and a film of copper chemically reduced from an aqueous solution by the use of a temporary oxide film. Data are reported on the physical properties of the bond and on oxidation reactions of copper. Electron diffraction patterns and micrographs of the oxides are presented. Chemical reaction products of each processing step have been observed and explored.

THURSDAY, JUNE 22

9:00 a.m. ..... Georgian Room

SESSION H

Session Chairman—*Dr. M. M. Beckwith*

CORROSION-CURRENT DATA FOR NICKEL-CHROMIUM COUPLES

by W. H. Safranek, H. R. Miller and R. W. Hardy, Battelle Memorial Institute

When nickel electroplate is coupled with chromium, a high current density and corrosion rate at the anode, usually nickel, are favored by a high electrolyte concentration, a high temperature, and a low nickel-to-chromium area ratio. The passivity of the chromium, which is dependent upon aging conditions, has a profound influence on the corrosion current. The information in this paper, based on research conducted for the American Zinc Institute, resolves some anomalies that obscured factors bearing on the corrosion of electroplated zinc die castings.

ELECTROPLATING OF ZINC-BASE DIE CASTINGS IN A SYSTEM INCORPORATING DUAL CHROMIUM

by James H. Lindsay, W. E. Lovell, Ternstedt Division of General Motors Corporation, and D. W. Hardesty, General Motors Corporation Research Laboratories

Zinc-base die castings for automobile body hardware have been electroplated on a large scale in a system involving the use of dual chromium. General plating practices are discussed. Problems arising from the use of dual chromium and the raising of performance standards are covered in some detail. Operation of the chromium baths is described, including discussion of factors involved in the maintenance of the micro-crack pattern. Corrosion resistance data are given.

THURSDAY, JUNE 22

2:00 p.m. ..... Grand Ballroom

SESSION I

Session Chairman—*Dr. Harold Narcus, Electrochemical Industries, Inc*

PLATING OF PRINTED CIRCUITS WITH PYROPHOSPHATE COPPER AND TIN-NICKEL

by R. W. Couch and R. G. Bikales, Metal & Thermit Corporation

Printed circuits require electrical reliability, wear and corrosion resistance. The copper/tin-nickel system can be plated from standard production baths at lower cost and with improved quality over copper-gold. Pyrophosphate copper produces smooth, dense coatings on the surface and "through holes." The copper solution is mildly alkaline and free of cyanide and has no affect on most commercial laminated board. Tin-nickel offers corrosion resistance, low contact resistance, solderability and retention of solderability when used as a top coat. Its hardness improves wear.

EVALUATION OF SOLDERABILITY OF ELECTROPLATED COATINGS

by L. K. Bjelland and J. M. Thompson, Convair-Pomona, A Division of General Dynamics Corporation

Various electroplated coatings were evaluated to determine the effect of shelf life on their solderability by exposing plated terminals to a factory atmosphere for periods up to one year. A tensile test was developed whereby solder joints were evaluated quantitatively to determine the quality of the connections. Other tests conducted included solderability, corrosion resistance, resistance to oxidation, and plating thickness. The results of the tensile test proved to be statistically valid. From this it was found that some electrodeposited films produced stronger and more reproducible connections than other coatings.

PRODUCING ULTRA-HIGH FREQUENCY ELECTRONIC PARTS BY ELECTROLESS COPPER AND PRECIOUS METAL PLATING ON PLASTICS

by Charles E. MacNeill, Materials Engineering and Development, Orlando Division, The Martin Company

A research program was conducted to evaluate the feasibility of producing ultra-high frequency electronic parts using electroless and precious metal plating on plastics. An optimum process was developed and the properties of plated parts evaluated. Typical electronic assemblies were fabricated using plated plastics to evaluate electronic characteristics. It was found that plated plastic parts could be substituted for plated metal parts to result in an improved end item.

R. W. Couch

R. G. Bikales

L. K. Bjelland

J. M. Thompson

Charles E. MacNeill

J. E. Trumbour
Treasurer

J. G. Carrique
1st Vice President

F. P. Green
President

Dr. H. L. Kellner
2nd Vice President

R. M. Norton
3rd Vice President

METAL FINISHING SUPPLIERS' ASSOCIATION

STATLER HILTON HOTEL—BOSTON, MASSACHUSETTS

E. A. Blount
Executive Secretary

SUNDAY, JUNE 18
11:30 a.m.—Board of Trustees Meeting ..... Room 409

MONDAY, JUNE 19
12 noon—Luncheon and Annual Meeting ..... Bay State Room
8:00 p.m.–1:00 a.m.—MFSA Ball. Continuous music for dancing, refreshments and snacks ..... Grand Ballroom
(Admittance by AES Convention Registration Badge)

WEDNESDAY, JUNE 21
8:30 a.m.—Golf Tournament ..... Marshfield Country Club, Marshfield, Mass.

THURSDAY, JUNE 22
6:00–7:00 p.m.—MFSA Cocktail Party ..... Georgian Room and Parlors A, B, & C
(Admittance by AES Convention Registration Badge)

R. F. Ledford
Past President

NATIONAL ASSOCIATION OF METAL FINISHERS

STATLER HILTON HOTEL—BOSTON, MASSACHUSETTS

Robert L. Giesel
President

THURSDAY, JUNE 15
6:00 p.m.–11:00 p.m.—Get Acquainted Party. Sponsor: Metal Finishers' Assn. of New England ..... Hosp. Room

FRIDAY, JUNE 16
8:30 a.m.–4:00 p.m.—Registration ..... Mezzanine
9:30 a.m.–noon—Annual Meeting & Election of Directors ..... Parlor A
1:30 p.m.–5:00 p.m.—Board of Directors' Meeting & Election of Officers ..... Parlor B
3:00 p.m.–5:00 p.m.—Ladies Tea & Style Show ..... Veranda Room
6:00 p.m.–8:00 p.m.—Dinner Meeting: Association Executives of NAMF Affiliated Groups ..... Parlors D–E

SATURDAY, JUNE 17
9:00 a.m.–5:30 p.m.—Registration ..... Mezzanine
9:00 a.m.–3:00 p.m.—Historic Tour. (Ladies & Children) ..... NAMF Desk
10:00 a.m.–4:45 p.m.—Three Management Seminars ..... Ballroom Annex
6:00 p.m.–8:30 p.m.—Final Registration ..... Bay State Room
7:00 p.m.—Reception and Cocktail Party ..... Bay State Room
8:00 p.m.—Banquet, Award Presentations ..... Bay State Room
9:30 p.m.—Entertainment, followed by Dancing ..... Bay State Room

SUNDAY, JUNE 18
9:00 a.m.—Golf Tournament ..... Portsmouth, N. H.
1:00 p.m.—Clambake & Outing ..... Portsmouth, N. H.

MONDAY, JUNE 19
9:00 a.m.–5:00 p.m.—Plant Tours ..... Greater Boston
8:30 a.m.–8:00 p.m.—Cruise to Provincetown (Ladies & Children) ..... Meet NAMF Desk

N. A. Vigeant
General Chairman

Sal Novelli
Ass't. Secretary Treasurer

Edward N. Marlette
1st Vice President

James E. Cogan Jr.
2nd Vice President

A. T. Leonard
Past President

Frank Kaiser
Secretary-Treasurer

P. Peter Kovatis
Executive Secretary

CONVENTION CHAIRMEN

Manson Glover
Co-Chairman for Finance

Louis V. Gagnon
General Chairman

Dr. George P. Swift
Co-Chairman for Administration

Mrs. George P. Swift
Ladies

Hubert H. Foley
Banquet

AMERICAN ELECTROPLATERS' SOCIETY CONGRATULATES AND THANKS

LIKE EVERY other national convention of American Electroplaters' Society, Inc. (AES) since AES's first as such held in 1913, the principal purpose of the AES's 48th Annual Convention being held in Boston, June 18–23, 1961, is to share technical and scientific knowledge in plating, metal and organic finishing and allied arts.

ASIDE FROM an educational sessions program expected to be among the most significant in AES's long convention history, moreover, the 48th Annual Convention has marshaled an array of "off duty hour" programs of relaxation, fellowship and entertainment expected to compare favorably with previous AES conventions.

TO THE commonwealth, municipal and civic leaders of Massachusetts and Boston who are welcoming AES to their great commonwealth and municipality, June 18–23—to the officers and members of the Society's Boston Branch that is hosting this large AES enterprise—to the fine industrial companies that have advertised in this Convention Issue of PLATING MAGAZINE and/or that are providing hospitality at the convention—to the leadership and personnel of the Host Branch Convention Committee—to the executives and staff of the Statler-Hilton Hotel and of other hostelries of the Bay City that are housing the Society's large numbers—to these, plus the learned men who will share their knowledge with AES's members attending the educational sessions, the Supreme Society, the Executive Board, National Headquarters and PLATING MAGAZINE express a hearty "thank you."

AND TO AES's members themselves, may your cup overflow with technical and scientific knowledge, and may you have much fellowship and fun in the "Athens of America," June 18–23, 1961, AES convention style.

George J. Marotta
Educational Chairman

James H. Anderson
Registration

Charles Levy
Educational Co-Chairman

John A. Swift
Publicity

John R. Wright
Hospitality

Mrs. George J. Marotta
Children

George E. Landis
Transportation

Paul F. Reddy
Hotel

Edmund S. Jevely
Plant Visits

Joseph T. Sullivan
Outing

RESEARCH COMMITTEE READIES 1961-1962 AES PROGRAM AT HEADQUARTERS MEETING

Meeting at National Headquarters, April 26, the AES Research Committee, with Chairman D. Gardner Foulke presiding, not only finalized the AES's 1961–1962 Research Program but also adopted its 1961–1962 budget, subject to ratification by the Research Annual Meeting to be held on June 21 in Boston, during the Society's 48th Annual Convention.

As enacted, the 1961–1962 AES Research Program continues Project No. 12 (Columbia University); Project No. 14 (Ontario Research Foundation); Project No. 15 (Detroit Area); Project No. 16 (University of Pennsylvania) and Project No. 18 (Chicago Area). It also includes new Project No. 19 at the National Bureau of Standards on the subject of the "Galvanic Effects Associated with Coating Failures" and new Project No. 20, under the aegis of the AES's Dallas-Fort Worth Branch, on the subject of "Plating by Thermal Decomposition."

A Serial Report on some results stemming from Project No. 12 (Serial Report No. 45) will issue to all Sustaining Members and others before fiscal year-end.

In addition to the enacted AES Research Program for 1961–1962, the Research Committee also continued the work of several task committees to explore the desirability of creating Projects on a number of specific phases of electroplating, metal finishing and allied arts.

The Committee also completed plans for the staging of its Annual Meeting on June 21. This will be launched with a breakfast meeting to be attended by National Officers; members of the Research Committee; District Supervisors; Regional Research Finance Chairmen; Project Chairmen, Directors and other Project personnel; Past Research Committee Chairmen and others. The Committee will there develop its final plans for its aggressive Sustaining Membership increase program for 1961–1962.

Members of the Committee present at the Newark meeting, besides Chairman Foulke, included Dr. William Blum, Richard A. Fellows, Dr. B. B. Knapp, Edward J. Kubis, Raymond L. Mitchell, Walter E. Moline, John P. Nichols, Clarence H. Sample, Whitney Snyder and Dr. Harold J. Wiesner.

BALTIMORE-WASHINGTON BRANCH PRESENTS POT TO PRESIDENT WESLEY AT ANNUAL MEETING

Some 130 members and guests of the Baltimore-Washington Branch attended its 33rd annual Dinner Dance and saw Past President Kenneth Huston present a pot to AES President Andrew Wesley on April 15. This was the sixteenth pot presented by the Baltimore-Washington Branch to an AES President as the first step to make him eligible to membership in the Past Presidents Association.

Past President Huston reviewed the important highlights of the Order of the Pot (predecessor of the Past Presidents Association) during the presentation. These included presentation of the first pot to Walter Pinner (1946); organization of the Order of the Pot (Milwaukee 1949); By-laws adopted (1949); first dinner meeting (Buffalo 1951); first organized dinner meeting (Philadelphia 1953); membership opened to Past Presidents serving before 1945 (Philadelphia 1953); first Convention Committee-sponsored dinner (New York 1954); name changed to Past Presidents Association (1954;) annual dinner made self supporting (Washington 1956); dinner meetings made part of Convention program (Washington 1956); first organized business meeting (Detroit 1959); Past Presidents AES Award established (Detroit 1959).

Sixteen pots have been presented by the Baltimore-Washington Branch to the National Presidents of AES and eleven by the Branch to Presidents serving before 1945. The Association now has 25 members. It demonstrates the loyalty and interest of the Society's past heads to the Society's continued growth and well being.

Awarding of door prizes and dancing followed the presentation.

National President with Baltimore-Washington Branch Officers, left to right, Treasurer Edward J. Roach, President Harold W. Scott, National President W. Andrew Wesley, Secretary Joseph Eisenberg, Vice President Lancaster Lowry, Educational Chairman James C. Withers.

HYDROGEN EMBRITTLEMENT BOOK BEING PUBLISHED BY REINHOLD

Published by the Reinhold Publishing Corporation by contractual arrangement with American Electroplaters' Society, Inc. (AES), the widely awaited reference book on hydrogen embrittlement in metal finishing will soon make its appearance for international sale by Reinhold.

Embodying all of the technical papers presented at the "Hydrogen Embrittlement in Metal Finishing Symposium" at the AES's 47th Annual Convention, Los Angeles, California, July 24–28, 1960, and supplemented by other papers and practical data on that subject, this timely and anticipated book's AES Editor is Dr. Harold J. Read, Professor of Physical Metallurgy at Pennsylvania State University and a member of AES's Pittsburgh Branch.

When published, AES members in good standing will, as usual, be able to procure copies through National Headquarters at a nominally reduced per-copy price. Payment must, of course, accompany any such AES members' orders. Watch the "AES Book Section" of PLATING MAGAZINE for further, fuller information.

AES ELECTROPLATING PRIMER SOON TO MAKE APPEARANCE

For single-copy purchase by individuals interested in a primer on electroplating and, in bulk, by such companies as wish to disseminate copies to trainees and other company personnel as an indoctrination visual aid, American Electroplaters' Society, Inc. (AES) will soon have available a compact, readable, illustrated booklet titled "Introduction to Electroplating".

Conceived originally by I. William Marcovitch, Secretary of AES's Philadelphia Branch, and authored for the AES Publications Committee by Ezra A. Blount, Editor, "Products Finishing Magazine" and a Past President of AES's Cincinnati Branch, the little booklet's publication by AES was recently approved and authorized by the Executive Board.

Designed by National Headquarters and now being published by it in usual publishing consultation with the Author, the first edition of the attractive little booklet will soon make its appearance. It will have limited complimentary distribution to AES chartered Branches and to a limited additional complimentary copy list. It will then go on sale at moderate "single copy" and "bulk quantity" published prices. Watch future PLATING MAGAZINE issues for further information.

AES NEWS

SAN DIEGO INSTALLED AS 60th AES BRANCH

The San Diego Branch, temporarily chartered November 1, 1960 and permanently chartered April 1, 1961, was installed as the 60th chartered Branch of American Electroplaters' Society, Inc. at a gala Branch Meeting held at the Coronado Hotel in Coronado near San Diego on Saturday, May 20. The installation team of AES National Officers was composed of First Vice President Chester G. Borlet and Executive Secretary John P. Nichols.

Present at the meeting besides San Diego Branch members were a number of representatives of other Pacific Coast AES Branches, notably Los Angeles that assisted in the creation of the neophyte but promising new Branch.

Apart from receiving its laminated AES permanent charter, the Branch also had its first roster of duly elected permanent AES Branch Officers installed. Harry Steinke took office as the Branch's first President. The full story, including text and pictures, will be carried in the July issue of PLATING MAGAZINE.

CENTRAL IOWA BRANCH TEMPORARILY CHARTERED

With a nucleus of 26 members, AES's Central Iowa Branch was recently temporarily chartered by the Executive Board effective April 1, 1961. The fledgling Branch must now operate successfully for a minimum of three months before applying to the Executive Board for permanent charter. If and when permanently chartered, it will then become AES's 61st Branch and the eleventh thus chartered since 1956.

Primarily based in the Cedar Rapids (Iowa) area, and with seemingly large potential for long AES life as an effective AES Branch, the probational Branch's creation was notably assisted by Past President Clyde Kelly.

Vernon Nus is the Branch's pro tempore titular head with James H. Elliott serving as its current Secretary-Treasurer pro tempore.

PROPOSED BUDGET AND AMENDMENTS OF AES LAW FINALIZED BY EXECUTIVE BOARD

Determined to stabilize the annual operating income and budgeted annual operating expense of American Electroplaters' Society, Inc. (AES) without further forseeable need for annual subsidy from AES financial reserves, the Executive Board, at its resultful full day and evening meeting held at National Headquarters, April 14, 1961, finalized Constitutional and Bylaw amendments for consideration by the Supreme Society, embodying necessary increases in the rates of AES's annual Per Capita Taxes and membership dues, effective the fiscal year starting July 1, 1962.

Despite the assaults of upward spiralling costs of everything affecting every individual and every enterprise, including AES, and the concurrently larger service demands upon AES voted by its governing council since then, the Per Capita Tax rate has nevertheless remained virtually unchanged since 1946, though a token increase (far less than was recommended by the Sixth Interim Meeting) passed in 1959. Being proposed are annual Per Capita Taxes for North American Branches of $11.50 and for Australian Branches, $7. Proposed, too, are Member-at-Large annual dues of $15 per person.

Before establishing its proposed Per Capita Tax and Member-at-Large dues increase rates per se, the Board compressed its proposed 1961–1962 operating budget to the utmost possible extent. As against a moderate $257,125 consolidated operating expense budget for 1960–1961 approved by the Supreme Society in Los Angeles in July 1960, the 1961–1962 proposed consolidated operating budget aggregates $230,555.

At that same meeting, the Board also finalized other Constitutional and Bylaw amendments being sought, including, for example, 1) that Branches pay Per Capita Taxes for new members starting with the quarter during which elected and 2) that the title be changed from "Branch Librarian" to "Branch Educational Chairman". All of the Board's proposed amendments were fully detailed in the May 1961 issue of PLATING MAGAZINE.

Among other business conducted at its April 14 meeting, the Board approved the design of the AES's new "Certificate of 25-Year Membership". When published, these will be offered by National Headquarters for purchase by AES Branches. Branches alone will then have the responsibility of determining who among their Branch members are eligible to receive them. Branches alone will then have th responsibility of purchasing and personalizing copies.

The Board, moreover, permanently chartered the new San Diego Branch as AES's 60th Chartered Branch. It prepared the Agendas for the coming Supreme Society Meeting. It authorized the Editorial Board to programme up to but not beyond 30 technical papers for the 1962 Annual Convention. It appointed members of AES Standing Committees for three-year terms effective June 19, 1961. It approved a resolution setting forth policy to govern AES's Sixth Industrial Finishing Exposition (St. Louis 1964). It authorized the publishing by National Headquarters of the AES booklet "Introduction to Electroplating" authored for AES by Ezra A. Blount and endorsed by the Publications Committee. It ratified the statement, "General Policy Governing Discussion Periods of AES Annual Conventions", approved and channeled to it by the Editorial Board.

Present at the Executive Board Meeting besides National President W. Andrew Wesley who presided, were First Vice President Chester G. Borlet, Second Vice President Manuel Ben, Third Vice President Frank O. Beuckman, Immediate Past President Ralph D. Wysong and National Executive Secretary John P. Nichols.

Sixteenth Annual Pot Presentation view, April 15, 1961, left to right, Third Vice President Frank O. Beuckman, First Vice President Chester G. Borlet, Baltimore-Washington Branch President Harold W. Scott, President W. Andrew Wesley, Past President Kenneth Huston, Immediate Past President Ralph D. Wysong, Second Vice President Manuel Ben.

NEW ENGLAND REGIONAL DRAWS CAPACITY ATTENDANCE AT 22nd ANNUAL MEETING

Surpassing all previous records for attendance, the 22nd Annual New England Regional Meeting was held at the Hotel Statler-Hilton, Hartford, Connecticut on Saturday, April 22. With 970 people present, the affair was a "huge success." AES National President W. Andrew Wesley was in attendance.

Educational Chairman Alexander R. Salmond presented two speakers at the Technical Session in the Capitol Room. Al Korbelak, vice president, Precious Metals Division of Sel-Rex Corporation spoke on "New Industrial Applications for Precious Metal Coatings" and the title of the paper given by Ralph E. Pettit, technical adviser of the metal industry department, Diversey Corporation was "Metal Etching—Functional and Decorative."

While the men were listening to the technical papers, the ladies played Bingo in the Terrace Room. Bob Boulay acted as master of ceremonies. Prizes were awarded to the winners.

The ladies joined the men at the Cocktail Hour hosted jointly by the Metal Finishing Suppliers, who also maintained an open bar following the Banquet until midnight. The Main Ballroom was filled by the banqueteers who enjoyed a delectable dinner, then dancing to William Glenny's Orchestra.

New Haven was the Host Branch this year. Harry Taylor was chairman of the Host Branch Committee. The members of his committee were Bernard Gaffney, Charles Kuster, Edward Jorczyk and John W. Beraqua. Mr. Salmond was assisted on the Educational Committee by Louis E. Dupuis, Elery C. Gibson and Henry L. Heissfeld of the Springfield Branch.

Publicity was handled by a Bridgeport Branch Committee consisting of William Hyatt, chairman; Robert Parker, Edmond Owen, William Lindsay, Joseph Haas and Emil Bergen. The Entertainment Committee was composed of members of the Hartford Branch, Walter Dyber, chairman; Stanley Grabowski, Stanley Platoz and Edwin Crandall. Mrs. Walter Dyber was chairlady of Entertainment. Program Advertising was in the capable hands of a Waterbury Branch Committee: Walter C. Giesker, chairman; Francis A. Schneiders, Louis Porretti, Spencer L. Henn and Albert Griffith.

In Memoriam

JOHN J. RENNIE

The Society has been saddened by the recent death of John J. Rennie of Verdun, Quebec, Canada, and President of AES' Montreal Branch.

Mr. Rennie was a life-long resident of Montreal, born in Point St. Charles in 1904. He obtained all his schooling in the Montreal area, and graduated from Mont Gabriel Academy. In addition to being President of the Montreal Branch of the AES, he was a member of the Railway Club of Montreal and the Knights of Columbus.

For the past ten years he served as sales representative for Montreal and Quebec of the Diversey Company of Canada. He is survived by his wife, Mrs. Thelma Hinton Rennie.

(Top left) AES National President Andrew W. Wesley opening the Educational Session of the New England Regional in the Capital Room of the Hotel Statler-Hilton, Hartford. L to r, Al Korbelak, Educational Chairman Alexander R. Salmond, Dr. Wesley, Louis E. Dupuis, Educational Committee; Ralph E. Pettit. (Top right) Attentive listeners at Educational Session. (Bottom left) The Ladies playing Bingo in the Terrace Room. (Lower right) General view of the Banquet in the Main Ballroom.

LIFT! HELP YOUR BRANCH ATTAIN ITS MEMBERSHIP EXPANSION GOAL

IMPORTANT TO AES BRANCHES AND BRANCH SECRETARIES

1. **A complete certified roster of your Branch Members in good standing as at June 30, 1961 must, by AES Bylaw provision, be in the hands of the National Executive Secretary on or before July 15, 1961. That list should include every member for whom your Branch paid Per Capita Tax in the July 1, 1960-June 30, 1961 fiscal year, including all new members, all reinstated members and all members "transferred in" during that period, minus all suspended, all resigned, all died or all "transferred out" members from July 1, 1960 through June 30, 1961. Upon arrival of your Branch list and its reconciliation with National Headquarter's records, your Branch will then promptly be billed by National Headquarters for Per Capita Tax for the fiscal year July 1, 1961-June 30, 1962 (References: AES Bylaws: Part I, Article V, Section 3, and Part II, Article V, Sections 4 and 5.)**
2. **Your Branch's duly elected 1961-1962 Delegates and Alternate Delegates take office at the first Branch Meeting immediately following the June 22, 1961 Annual Meeting (Boston) of the Supreme Society. A Return Sheet will reach you about September 1 from National Headquarters. In conformity with AES law you will be required to identify and certify these 1961-1962 Delegates and Alternate Delegates for accreditation by the 1961-1962 Credentials Committee. Your executed Return Sheet duly signed by your Branch President and Branch Secretary must be at National Headquarters on or before November 6, 1961.**
3. **You have received a Return Sheet to convenience your report to National Headquarters as to your elected 1961-1962 Branch Officers. If you have not yet executed and returned yours, please do so by return mail.**

FUTURE MEETINGS

Education is the business of AES. For National, Regional and Branch educational and other AES meetings ahead, see PLATING's section titled FUTURE MEETINGS herein.

SIGNIFICANT TWO-DAY AES RESEARCH CONFERENCE HELD AT BELL LABORATORY, APRIL 24-25

Following in the footsteps of the successful two-day AES Research Conference held at the National Bureau of Standards, Washington, D. C. in December 1957, the two-day 1961 version held at the Bell Telephone Laboratories, Murray Hill, N. J., April 24–25 drew a substantial number of conferees that participated in a highly effective and resultful Research Conference.

The conferees, including AES National Officers; members of the AES Research Committee; Research District Supervisors; Regional Research Finance Chairmen; Project Chairmen and Directors; Project Fellows; former Research Committee Chairmen and executives of AES Sustaining Member companies, were welcomed to the Opening Session, Monday morning, April 24 by Dr. N. B. Hannay, Chemical Director of Bell Laboratories. AES National President W. Andrew Wesley responded for the Society and its Research Program.

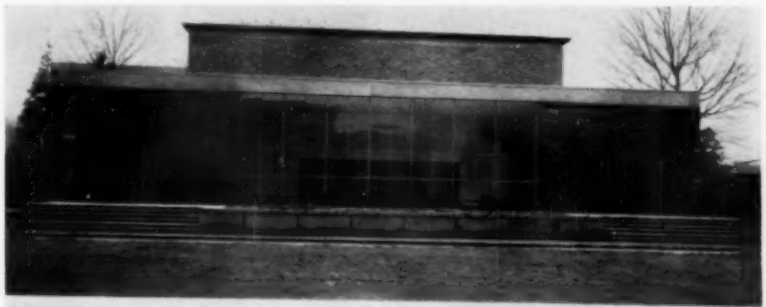
With Research Committee Chairman D. G. Foulke presiding, the Conference that Monday forenoon then heard Project 12, "The Cleaning and Preparation of Metals for Electroplating," discussed by Dr. H. B. Linford; Projects 13, "The Nature, Causes and Effects of Porosity in Electrodeposits," and 19, "The Galvanic Effects Associated with Coating Failure," by Fielding G. Ogburn and Project 14, "The Influence of the Physical Metallurgy and Mechanical Processing of the Basis Metal on Electroplating," by Dr. M. H. Jones.

Dr. Harold J. Wiesner, Vice Chairman for Research, moderated that day's Afternoon Session which featured discussion of Project 15, "Accelerated Corrosion Tests for the Performance of Plated Coatings," by AES Past President Walter L. Pinner; Project 16, "Mechanism of Electrodeposition," by Dr. J. O'M. Bockris and Project 17, "Microthrowing Power," by Dr. Henry Leidheiser.

Dr. Wesley presided at the Tuesday Morning Session. There William Geissman covered Project 18, "Mechanical Finishing of Metal Surfaces," and Myron E. Browning discussed Project 20, "Plating by Thermal Decomposition." A round table then followed on the subject "Needed Research in Electroplating." Panelists were Drs. William Blum, Walter A. Meyer and W. A. Wesley.

The important Research Conference concluded Tuesday afternoon, April 25 with a conducted tour of Bell Telephone Laboratories.

The Conference Committee responsible for the Conference and its arrangements in behalf of the AES Research Committee was ably lead by August Mendizza as Chairman, aided by Past Research Chairman Robert A. Ehrhardt and Dr. Dennis R. Turner.



(Top) Auditorium of the Bell Telephone Laboratories at Murray Hill, N. J., scene of the 1961 Research Conference held on April 24 and 25. (Bottom) Research Conference Participants, left to right, Dr. D. Gardner Foulke, 1960–61 Chairman of the AES Research Committee and Chairman of the First Session of the Conference; August Mendizza, Conference Chairman; Dr. W. Andrew Wesley, AES National President and Chairman of the Third Session; Dr. Harold J. Wiesner, 1960–61 AES Research Committee, Vice-Chairman Research, and Chairman of the Second Session.

OPPORTUNITY TO AUTHORS INTERESTED IN MILWAUKEE CONVENTION PARTICIPATION

Emphasis being placed in programming the AES's Annual Convention to occur in Milwaukee, Wisconsin, June 24–28, 1962 is upon creating an educational program so significant and appealing, that few persons seriously interested in educational enrichment in electroplating, metal finishing, organic coating and other such subjects can afford to miss it.

Member or non-member authors of original, unpublished technical and scientific papers on electroplating, metal finishing, organic coating and allied arts wishing to be considered as prospective participants in that Milwaukee educational program are cordially invited to communicate either with Host Branch Educational Chairman Joseph Andrus direct (Address: 62-01 Howard Street, Chicago 48, Illinois) or through the Editor of PLATING MAGAZINE, 443–445 Broad Street, Newark 2, New Jersey.

Particularly desired for consideration are proposed original technical papers on the subjects of mechanical finishing, organic coating, pickling and etching of aluminum for finishing purposes, etc.

The Editorial Board will consider the preliminary program at its meeting in September 1961. You are consequently urged to record your availability with Mr. Andrus forthwith. State your subject (and send a preliminary abstract if possible) but please do not submit any manuscript until after the full particulars as to specifications have been sent to you.

MILWAUKEE: SITE OF AES's 1962 ANNUAL CONVENTION

Hosted by the AES Midwest Regional Council with the AES's Milwaukee Branch as Host Branch, the 49th Annual Convention of American Electroplaters' Society, Inc. will be held, June 24–28, 1962, in America's famed Milwaukee, Wisconsin, an aerial view of which is presented above.

This will be the fourth time that Milwaukee has been site of an AES Convention (prior occasions were 1924, 1938 and 1949) but the first time in AES history that an AES Annual Meeting will be hosted by an AES Regional Council rather than by an AES Branch per se. Constituent Branches of AES's Midwest Council include Chicago, Milwaukee, Mississippi Valley, Rockford, St. Joseph Valley and St. Louis.

Convention General Chairman is Herman A. Tessmann of the Milwaukee Branch, with Past National President Ralph D. Wysong (St. Joseph Valley Branch) and Leonard Weeg (Rockford Branch) respectively as Assistant General Chairmen.

MILWAUKEE BRANCH AND MIDWEST COUNCIL SHARE APRIL 29 MEETINGS SPOTLIGHT

Milwaukee Branch's famed Annual Educational Meeting and Banquet was held at the Schroeder Hotel of that municipality Saturday, April 29, 1961, and drew its usual large audience of Branch members and their families, plus the members and families of nearby Branches, especially Chicago, Rockford, Mississippi Valley, St. Joseph Valley and St. Louis.

Apart from a Banquet that filled the Schroeder Hotel's Ballroom to capacity, it featured an Educational Session immediately after its Annual Luncheon acclaimed for its versatility and quality. The Session attentively heard Professor Elgie Marcks of the Economics Department of the University of Wisconsin memorably discuss the social and economic values of our nation's private enterprise system. It also heard Robert L. Giesel, President of the Adolph Plating Company of Chicago present "Metal Finishing for Profit". It also heard Frank O. Beuckman, Eastman Kodak Company, on the subject of color photography.

The Milwaukee Branch Annual Meeting was preceded by a Friday evening meeting of the AES's 49th Annual Convention Steering Committee, with General Convention Chairman Herman A. Tessmann presiding. Members of that Committee also present were AES Past President Ralph D. Wysong; Midwest Regional Council Chairman Leslie L. Diveley; Milwaukee Branch President Gene Piellusch; Midwest Council Secretary Paul Glab and Milwaukee Branch First Vice President Arthur M. Linn. Also present were National First Vice President Chester G. Borlet and National Executive Secretary John P. Nichols. That AES National Convention will be held in Milwaukee June 24–28, 1962, with the AES Midwest Council as regional sponsor, and the Milwaukee Branch as Host Branch.

On Saturday morning, the AES Midwest Regional Council itself held its meeting with full representation from constituent AES Branches, namely Chicago, Milwaukee, Mississippi Valley, Rockford, St. Joseph Valley and St. Louis. Chairman Diveley presided. Among much other transacted business, it named the St. Louis Branch as host of the Council's Fourth Annual Meeting. It will be held in the St. Louis area in the Autumn of 1962. Guests at the Council's executive session included AES National Officers Borlet, Beuckman and Nichols.

The respective Committee Chairmen of the AES's coming 49th Annual Convention then met in an assignment, indoctrination and coordination meeting with Chairman Tessmann that Saturday afternoon.

(1) Registration at the Empire State Regional Meeting/Rochester Branch Golden Anniversary. (2 & 3) Views of the audience at the Educational Session. (4) The Ladies Luncheon. (5) The Annual Banquet, head table in background. (6) Corner of the Ballroom during Banquet. (7) Empire State Regional Board Luncheon, from left, Rolland E. Campbell, Buffalo; John Donaldson, Buffalo; Charles G. Bound, Southern Tier; John H. Green, Capitol District; Peter VanDilst, Rochester; Milton F. Stevenson, Syracuse; Morgan D. Rake, Southern Tier; Edwin C. Elliott, Syracuse; Robert J. Krawczyk, Mohawk Valley; Ted Duvall, Mohawk Valley; Fred C. Thiem, Rochester; James F. Luker, Mohawk Valley. William B. Rossiter, Southern Tier, was at far left beyond camera range. (8) Mrs. Schaeffer, General Chairman Vern Schaeffer and Mrs. John Cipolla at Banquet head table. (9) L to r, R. Scott Modjeska, William M. Tucker, Gerald A. Lux, John Cipolla, King Ruhly, David J. Miller, Frank O. Beuckman and Dr. W. Andrew Wesley.

ROCHESTER BRANCH OBSERVES GOLDEN JUBILEE AT EMPIRE STATE REGIONAL ANNUAL MEETING

Rochester Branch had the double distinction on Friday and Saturday, May 5 and 6, of celebrating its Fiftieth Anniversary and being the Host Branch for the Seventh Empire State Regional Meeting. The dual affair was held at the Hotel Manger in Rochester, with Vern Schaeffer as general chairman. The member Branches in the Empire State Regional are Buffalo, Mohawk Valley, Rochester, Southern Tier and Syracuse.

In a Gay Nineties atmosphere—replete with black derby hats, very fancy shirts, flowing mustaches, pretzels and beer—a thoroughly enjoyable Get-Acquainted Party started at nine o'clock on Friday evening and continued until after midnight. Dancing added to the merriment.

At the Empire State Regional Committee luncheon meeting on Saturday, James F. Luker of the Mohawk Valley Branch was elected its chairman for the coming year.

AES National Third Vice President and Educational Chairman Frank O. Beuckman presided at the Educational Program.

The first moderator, Dr. W. Andrew Wesley, presented King Ruhly, Michigan Chrome and Chemical Company, who explained in detail "Fluidized Bed Coatings." His presentation was illustrated with color slides.

Moderator William M. Tucker introduced R. Scott Modjeska of Scientific Control Laboratories. Mr. Modjeska gave a review, also employing slides, of "Plating on Difficult Basis Metals."

Gerald A. Lux, Oakite Products, Inc., was moderator for the final paper of the session given by David J. Miller of Deering Milliken, Inc. "Engineered Buff Fabrics" was the subject of Mr. Miller's presentation, which included an informative motion picture showing the processing of cotton.

The Metal Finishing Suppliers' Association hosted a Cocktail Party prior to the Banquet. Two hundred and eighty guests attended the Banquet in a beautiful setting in the Ballroom. As the dinner drew to its close, General Chairman Schaeffer greeted the guests and expressed his appreciation to all of the committees whose hard work had made the occasion such a splendid success. He introduced the ladies and men at the head table, the last of whom was Councilman Frank Horton, bearer of personal greetings from Mayor Berry of Rochester.

Branch President John Cipolla spoke briefly and thanked the Mohawk Valley Branch for stepping aside this year so that Rochester Branch could combine its Golden Anniversary celebration with the Annual Meeting of the Empire State Regional. He introduced Branch Past President Ray Berghold, a member since 1929. Mr. Berghold will be 75 years young this summer.

AES National President W. Andrew Wesley congratulated the Branch on its Fiftieth Anniversary and spoke optimistically of the future.

Dancing followed the Banquet.

The Golden Anniversary program booklet, appropriately encased in gold covers, contained a history of the Branch.

INTERSOCIETY NEWS

MFSA TO HOLD ANNUAL MEETING IN BOSTON

The Board of Trustees of the Metal Finishing Suppliers' Association will meet at the Statler Hilton Hotel in Boston, Mass. on Sunday, June 18. The following day, MFSA members will attend their annual luncheon and meeting.

On Monday evening, the MFSA will be host to all AES Convention registrants at its Annual Ball and Open House Party at the Statler Hilton Hotel.

Robert M. Burford

On Wednesday, June 21, the MFSA golf tournament will be held at Marshfield Country Club, Marshfield, Mass. Robert M. Burford Jr. is chairman of the golf tournament.

On Thursday evening, June 22, MFSA will give a cocktail party for all AES Convention registrants, just prior to the Convention Banquet.

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NTTCIW SPECIAL MEETING ON RESEARCH

Dr. D. Gardner Foulke, AES member and vice chairman of the National Technical Task Committee on Industrial Wastes reports that a successful meeting on research in the area of industrial wastes and water usage was held April 11–12 in Cincinnati.

Some 65 scientists and engineers concerned with industrial wastes met at the Robert A. Taft Sanitary Engineering Center to listen to reports on research progress. Of interest to the plating industry was the report on "Determination of Water Quality Requirements for Protection of Aquatic Life" by C. M. Tarzwell who stated that hydrocyanic acid, not the complex cyanides, was toxic to fish and that an analytical method for the determination of undissociated HCN had been developed. Bernard Berger, chief, Research Branch reported considerable contract research will be let out by the Center and R. Holtje reported that more money would be available as research grants under the Public Health Service.

G. N. Mc Dermott reported that copper cyanide reduced the efficiency of activated sludge treatment more than copper sulfate. This work is almost completed after which the effect of nickel will be studied. Hexavalent chromium, short of massive slug doses is unlikely to harm the operation of a sound sewage treatment plant. The retention of the chromium is primarily in the activated sludge solids and a digestor with 3.5 per cent chromium in the sludge solids performed satisfactorily.

In view of the exploding population and rocketing industrial growth, water use will increase tremendously in the next 15 years. This means greater reuse by recycling and by better treatment so that effluents can be used time and again. The Center is embarking upon a program of Advanced Waste Treatment Research with the objective of solving such problems as removal of organics, minerals and solids by an imaginative, progressive approach.

The NTTCIW in a brief business session passed resolutions 1) recommending a continuing study of the application of stabilization ponds to sewage and industrial waste treatment, 2) reaffirming past support of the need for increased research and 3) recommending that consideration of permissive legislation permitting one-year tax write-off of the cost of industrial waste disposal installations.

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NACE TO CONDUCT BOSTON CORROSION COURSE

A corrosion course on fundamentals will be conducted by the Greater Boston Section of the National Association of Corrosion Engineers, June 20–22, 1961. It will cover the need for corrosion study, causes of corrosion, construction materials and coatings, cathodic protection, and other practical solutions to corrosion problems.

The three-day course will be held at Wentworth Institute, Boston. Chairman for the short course is W. S. Sanders Jr., Algonquin Gas Transmission Co., 25 Faneuil Hall Square, Boston 9, Mass.

Program for the course follows:

June 20: "The Need for Corrosion Education," Manson Glover, Glover Coating Co., Inc.; "The Need for Corrosion Engineering," Robert Zinn, A. D. Little, Inc.; "Fundamental Science of Corrosion", H. C. Gatos, Lincoln Labs., MIT; "Corrosion in Action," motion pictures from The International Nickel Co., Inc.

June 21: "Materials of Construction—Iron and Nickel Base Alloys," W. Z. Friend, The International Nickel Co., Inc.; "Materials of Construction—Aluminum and Copper Alloys," Wilson Lynes, Revere Copper & Brass, Inc.; "Organic Coatings—Properties," Russell Gackenbach, American Cyanamid Co.; "Coatings and Linings—Applications," Henry W. Foelsch, Lithcote Corp.

June 22: "Principles of Cathodic Protection," T. P. May, The International Nickel Co., Inc.; "Applications of Cathodic Protection," A. W. Peabody, Ebasco Services Inc.; "Designing to Prevent Corrosion," S. K. Coburn, Applied Research Labs., United States Steel Corp.; "Practical Solutions to Corrosion Problems," J. H. Peacock, The Duriron Co., Inc.

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ZINC TRENDS HEARD AT AZI MEETING

More than 400 major representatives of the zinc industry and steel mill galvanizers gathered at Chicago, May 1 to 3, to discuss fluctuating U. S. and foreign zinc markets, and to learn about new trends in zinc consumption and usage here and abroad. The occasion was American Zinc Institute's 43rd Annual Meeting, at Chicago's Drake Hotel.

Coming together from the industrial centers of the nation and other countries of the Free World, including Australia, Canada, England, France, Germany, Japan, Mexico and the Netherlands, the meeting of zinc industry executives dis-

cussed significant considerations underlying healthy continuation and expansion of their major markets, including the new role of galvanized steel in automotive production, and the importance of die casting product design, a major zinc outlet. Other topics of broad industrial interest included the impact of foreign car manufacture, as well as a comprehensive report on zinc's international status. The meeting also learned details of the zinc industry's recently created Expanded Research Program.

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CHALMERS TO PRESENT MARBURG LECTURE

Dr. Bruce Chalmers, Gordon McKay Professor of Metallurgy, Harvard University and editor of *Acta Metallurgica*, will present the annual Edgar Marburg Lecture at the 64th Annual Meeting of the American Society for Testing Materials, Chalfonte-Haddon Hall, Atlantic City, Monday afternoon, June 26, 1961. In this annual lecture, a memorial to the first secretary of ASTM, leaders in their respective fields describe outstanding developments in our knowledge of engineering materials. Anyone interested is welcome to attend.

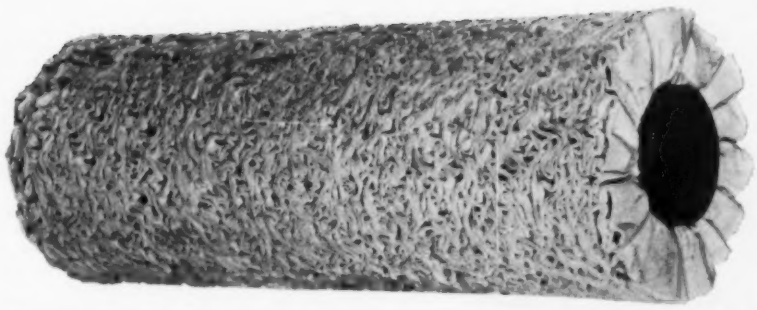
Dr. Chalmers will discuss the theory of static nucleation and the existence of dynamic nucleation processes. The process of crystal growth from the melt will be examined in terms of the structure of the solid-liquid interface and thermal and chemical conditions.

Dr. Chalmers is a native of London, England. He received his BSc and PhD degrees in physics at the University of London in 1929 and 1931, respectively. He was awarded the degree of DSc by the University of London in 1941.

He lectured in physics and mathematics at Sir John Cass Institute, University of London, from 1932 to 1938. He was physicist at the Tin Research Institute from 1938 to 1942. In 1942 he became head of the metallurgy department, Royal Aircraft Establishment, Farnboro, and in 1946 became head, metallurgy department, Atomic Energy Research Establishment, Harwell. From 1948 to 1953 he was professor of physical metallurgy, University of Toronto. In 1953 he assumed his present position.

Dr. Chalmers is the author of "Physical Examination of Metals," "Structure and Properties of Metals and Alloys," and "Physical Metallurgy." In addition he is editor of *Acta Metallurgica* and *Progress in Metal Physics*.

In 1954 he was the Institute of Metals Division lecturer, American Institute of Mining, Metallurgical and Petroleum Engineers. He received the Albert Sauveur Award of the American Society of Metals in 1961. He is a member of the Institute of Physics, the Institute of Metals, the American Society of Metals, Sigma Xi, and the Institute of Metallurgists.



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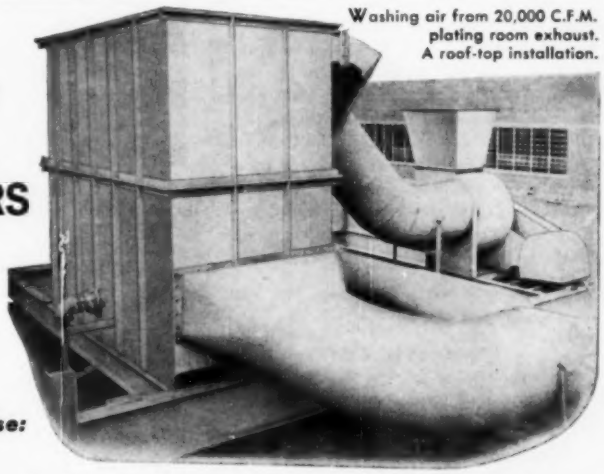

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INDUSTRY NEWS

A. J. Kolb, center, receives sales award amid smiles of Mrs. Kolb.

SALES AWARD TO KOLB OF ENTHONE

Albert J. Kolb, sales engineer for Enthone, Inc., of New Haven, Connecticut was presented a Distinguished Salesman's Award by the Sales Executives Club of New Haven at their 4th Annual Distinguished Sales Award Dinner. The affair was held recently at Waverly Inn in Cheshire and was attended by more than 500 sales executives, including a large group from Enthone and its parent company, American Smelting and Refining Co.

The award is presented annually to outstanding salesmen whose achievements have fostered the ideals of free competition in America. Mr. Kolb was selected because of his fine record during his 3 and one-half years of selling for Enthone. In 1960, he was top salesman in the Eastern United States in a contest sponsored by a manufacturer whose products Enthone distributes. In the recently completed Enthone "Top Gun" sales campaign, he finished first in New England by a wide margin.

♦

ASSOCIATION OF LAWRASON, CANADA WITH KELITE ANNOUNCED

S. F. Lawrason & Company Limited of London, Ontario, Canada has become associated with Kelite Corporation.

Lawrason, an old and well established Canadian chemical manufacturing and distributing firm, will handle manufacture and sale of Kelite chemical compositions and the distribution of its equipment in the Provinces of Ontario, Quebec, Nova Scotia, New Brunswick, and Prince Edward Island.

At its London, Ontario headquarters, Lawrason operates a fully equipped factory, with a modern laboratory for production control and technical service. It also has manufacturing and sales facilities in Toronto and Montreal.

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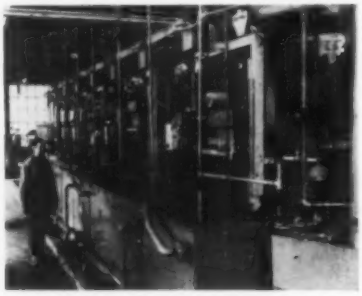


Installation at the Production Finishing Co. plant in Cleveland of Udylite's VIP plating machine.

UDYLITE HOLDS VIP PROVING WORTH IN PRODUCTION

Designed and built by The Udylite Corporation, the VIP (variable, integrated, processing) machine is said to have already proved its value to industry by increasing production, decreasing labor costs and reducing maintenance up to 70 per cent. Additional advantages reportedly include savings in metal to be plated, by means of better distribution on the work, and savings of "dragout".

The VIP's "brain", focal point of the plating machine, is a central control panel from which a variety of transfers, delayed dips, barrel rotations, dwell periods and power can be programmed to meet most plating requirements currently in demand. Although the entire plating operation is normally controlled by one man through operation of the central panel, each barrel and carriage assembly containing parts that are being plated may be controlled separately.

Uniformly good coverage and thickness of the deposit on the work reportedly is obtained with the VIP because of controlled automatic cycling by the "brain", which may also regulate the amount of time each perforated barrel rotates over a tank providing drainage.

The heart of the VIP's design is the combination of a motor, an over-running clutch and a self-locking type of speed reducer. When a barrel revolves in the "down" position, the clutch over-rides (like free-wheeling on a bicycle).

Each barrel has an individual, dual-purpose electric motor which rotates the barrel and also elevates it for horizontal transfer.

Each barrel may be left in the "up" position indefinitely. During a trial or limited run, any number of barrels may be set to go around the machine in the "up" position.

The VIP's "brain" controls a system of importance to the machine: multiple indexing. Multiple indexing permits the central control panel to program barrels through the processing and plating tanks at different rates of speed, keeping the plating tank full at all times.

♦

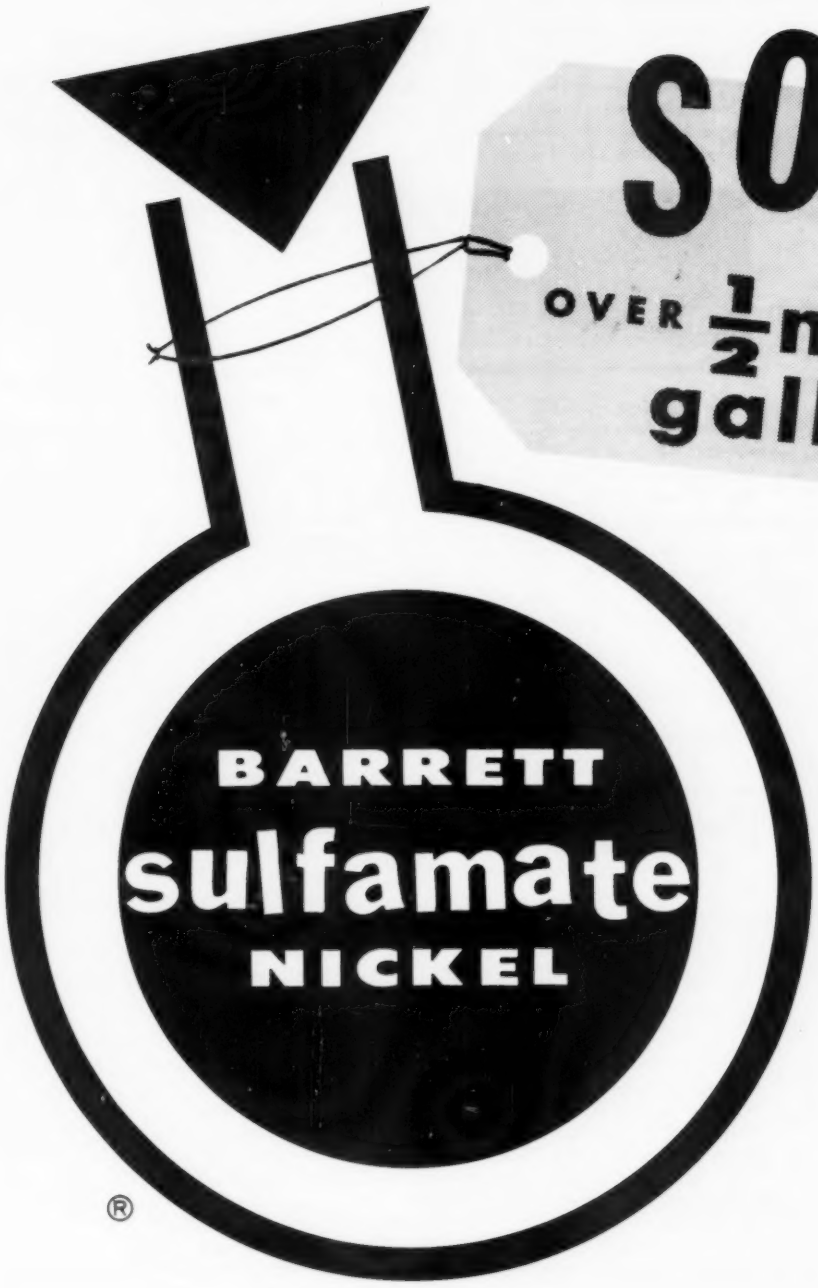
RAPID ELECTRIC COMPLETING PUERTO RICAN PLANT

Complete facilities to fabricate metal cabinets for standard line or custom rectifiers are presently being installed by Rapid Electric at its fifth plant to be opened in Puerto Rico in July. Consisting of heavy shears, punch presses, welders, pan-breaks, spray booths and associated equipment, the planned July opening is well ahead of schedule.

The 12,500 sq ft plant in Arecibo, Puerto Rico will also be used for subassembly work of standard rectifiers.

With the manufacturing of cabinets, over 85 per cent of major rectifier components will have become self-manufactured.

Based on this move and cabinet design changes adjusted prices on standard units will soon be issued to the plating industry.



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HARSHAW APPOINTED SO. CALIFORNIA DISTRIBUTOR FOR COWLES

Cowles Chemical Co., Cleveland, Ohio, has appointed The Harshaw Chemical Co. exclusive distributor of Cowles metal finishing products in Southern California. Headquarters for this new operation will be Harshaw's Los Angeles office. The Harshaw appointment is part of the company's program for increased emphasis on metal markets.

Harshaw's distribution in areas other than Southern California will not be affected by this new arrangement, according to a Harshaw spokesman. Cowles will support sales efforts with a full time resident technical representative.

♦

ALCOA SELLS FLUORIDE FACILITIES TO STAUFFER

Purchase of the special fluorides-producing facilities of Aluminum Company of America at East St. Louis, Illinois, has been announced by the Stauffer Chemical Co. Responsibility for the sale of its products has been assigned to Stauffer's Industrial Chemicals Division.

Distribution of the new fluoride products will be handled through the Industrial Chemicals Division's sales offices in New York, Philadelphia, Chicago and Atlanta. No changes are contemplated in sales and distribution policies, nor in plant personnel to insure continuation of current product quality.

♦

GROUP FORMED TO FIGHT AIR POLLUTION

Another step was taken in New York on March 4 in the national problem of air pollution control at a meeting of the Industrial Gas Cleaning Institute, Inc., with headquarters at 23 West 45th Street.

The organization is composed of the manufacturers of equipment designed to remove solid and liquid pollutants from the discharge of furnaces, kilns, chemical processes and other creations of the industrial age. These gas cleaners include electrostatic precipitators, mechanical collectors, fabric filters and net scrubbers.

DIVERSEY MOVES TO NEW CHICAGO HEADQUARTERS

The Diversey Corp. has moved its general offices, research and development laboratories, and Central Division sales offices to a modern five-story air-conditioned building in downtown Chicago.

The building, located at 212 West Monroe St., was formerly occupied by the Chicago office of the Federal Bureau of Investigation. Diversey's former quarters were at 1820 West Roscoe St., about four miles north of the loop.

The downtown location was chosen because of its convenience to public transportation, convention sites, major hotels and other facilities.

♦

WESTINGHOUSE APPOINTS WESTERN ULTRASONIC DISTRIBUTOR

Western Ultrasonics, Inc., of Monterey Park, has been appointed distributor for Westinghouse ultrasonic cleaning equipment.

With offices at 664 Monterey Pass Road, Monterey Park, the firm will be distributor for ultrasonic cleaning equipment for the states of California, Arizona, Oregon, Washington, Idaho, Nevada, New Mexico and Utah.

The firm, headed by W. J. Salzer, is an engineering research and development company in the field of ultrasonics and electronics. It will handle the Westinghouse line of ultrasonic cleaning equipment manufactured at its Industrial Electronics Department in Baltimore, Maryland.

INCO PROVIDES NEW METALS LIBRARY

The first reference library of specimens illustrating natural and applied colors, patterns, textures, plating and finishes of hundreds of metals and alloys was introduced on April 27 to some 300 members of the American Institute of Architects, which was holding its annual convention in Philadelphia.

Created by The International Nickel Company, Inc. specifically to serve the needs of architects and designers, the Inco Metals Library contains specimens of a wide range of metals, along with data on coatings, reflectance, color, finishing sequence and applications.

The sample metal panels are catalogued in groups on convenient sliding display boards. Each panel, magnetically attached to the board, may be easily removed for close inspection. Its reverse side is labeled as to material and finish.

F. L. LaQue, Inco vice president and manager of the company's Development and Research Division, said at the showing of the Metals Library for Architects at the Racquet Club, "Architects and designers have long been accustomed to having available for convenient inspection all sorts of samples illustrating colors, textures, patterns etc. available in paints, fabrics, masonry and the like. While they have been aware of what might be available along the same line in the family of metals, there has been no convenient way to scan the field in all its possible variations. The Metals Library was designed to fill this gap in an orderly way."

The library for architects introduced in Philadelphia is a branch of the main Metals Library located at Inco's New York headquarters, 67 Wall St. The main library will eventually contain 500 different specimens of metals suitable not only for architectural design, but also for designers of automobiles, appliances, etc. It now contains 150 specimens, including many varieties of stainless steels, plated surfaces and non-ferrous alloys. As new patterns, colors and textures are created, specimens will be added.

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INDUSTRY NEWS BRIEFS

MACDERMID OBTAINS TRADE MARK APPROVAL

The United States Patent Office has approved the use of Metex CI as the registered trademark of MacDermid Incorporated, Waterbury, Connecticut, for the company's line of copper brighteners. The newly registered trademark will be used in conjunction with the words, "Copper Brightener", and the entire trade name will be Metex Copper Brightener CI.

♦

RESEARCH SHOWS RUST PREVENTIVE ADVANTAGES OF MOLYBDATES

Recent research reveals that calcium and zinc molybdates equal or exceed the rust preventive characteristics of red lead and other inhibitors commonly used. So say scientists at Battelle Memorial Institute, where the research was conducted for Climax Molybdenum Co., a division of American Metals Climax Inc. Benson G. Brand and Helmuth O. Schoen of the Columbus (Ohio) research center note also that molybdates have two other advantages not shared by red lead, zinc chromate and iron oxide: They are nontoxic and white.

In evaluating the rust inhibiting characteristics of the molybdates, scientists exposed coated panels in rural Ohio, at Battelle's North Florida Research Station near Daytona Beach, and under accelerated conditions in laboratory weathering equipment.

The whiteness of the molybdates, the scientists point out, could provide an advantage where light-colored undercoats are essential. It may be possible, by proper formulation, to combine corrosion resistance and decorative finish in a one-coat treatment for metal surfaces.

♦

NEW CATALOG AVAILABLE FROM AMERICAN STANDARDS

Publication of a 1961 Catalog of American Standards which now number 1973 has been announced by the American Standards Association.

The booklet, available without charge from the ASA, contains a listing of special publications in the standardization field, pamphlets and standards recommendations of the International Organization for Standardization and the International Electrotechnical Commission. It also has an index to titles of American Standards and international recommendations.

Copies of the catalog may be obtained from the ASA, Dept. PR 214, 10 East 40th Street, New York 16, N. Y.

♦

ENGELHARD OFFERS TECHNICAL JOURNAL

Precious metals research in six fields by scientists of Engelhard Industries, Inc. is summarized in the current issue of Engelhard Industries Technical Bulletin (Vol. I, No. 4). The 56-page issue marks the completion of the first year of publication of the quarterly scientific journal and contains indices by subject, author and patent entries of the first four numbers.

The six research areas covered are: catalysis, purification of gases, cathodic protection, analytical procedures, stress-rupture properties of some platinum and palladium alloys, a silver electroplating anode, and metallo-organic films on refractory materials. Other articles in the technical bulletin detail the suitability of pure silver as a material of construction for handling hydrochloric acid and ammonium chloride, and a keyed platinum coating technique as a new approach to the protection of refractories against erosion by molten glass.

Copies of the technical bulletin may be obtained from the Technical Service Department, Engelhard Industries, Inc., 75 Austin Street, Newark 2, New Jersey.

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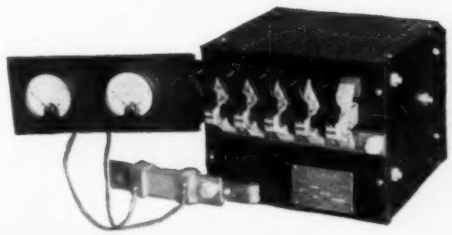

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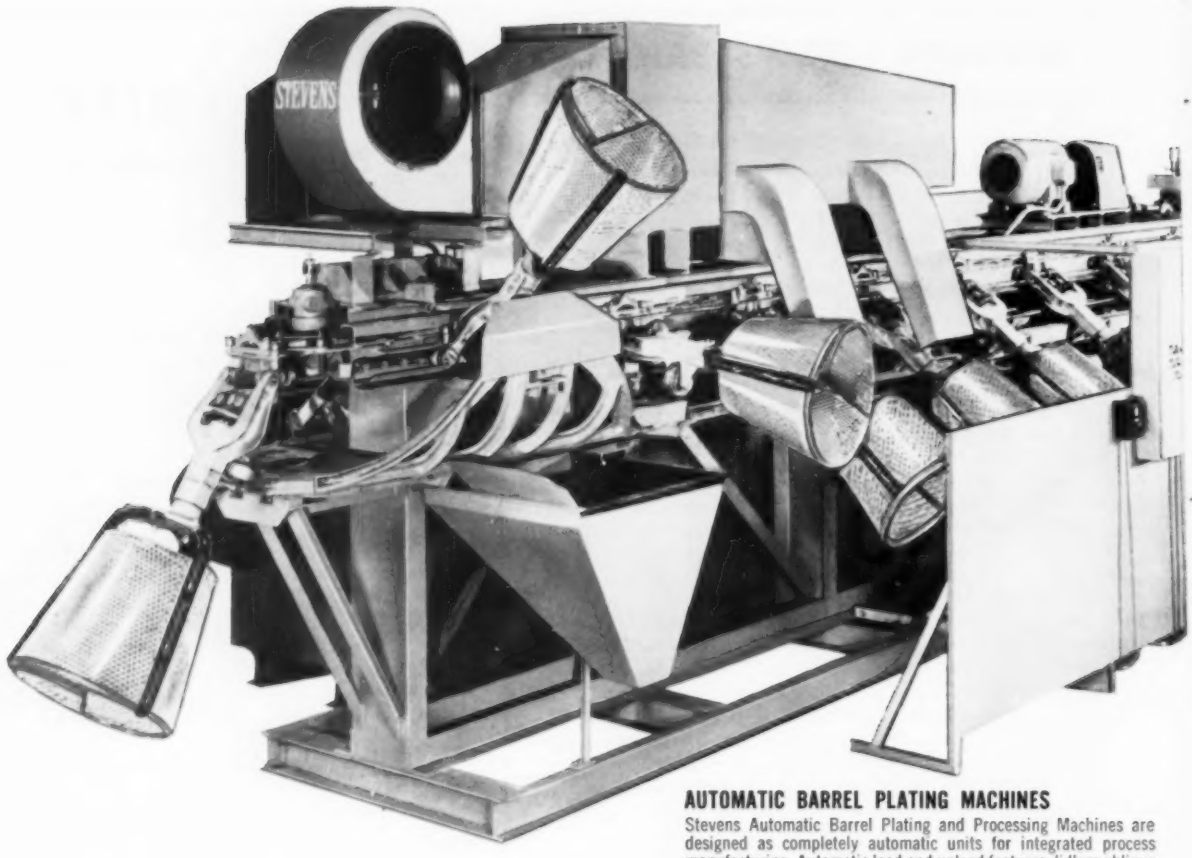

AUTOMATIC BARREL PLATING MACHINES

Stevens Automatic Barrel Plating and Processing Machines are designed as completely automatic units for integrated process manufacturing. Automatic load and unload features, lidless oblique barrels and optional built-in dryers provide the most economical and rapid means of plating small and medium-size parts.

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For more than fifty years, Frederic B. Stevens, Inc., has been a leader in the development and sale of prefinishing and plating equipment and supplies. If you have parts to buff, polish, clean and plate, this experience is yours for the asking. Naturally, the equipment to do this work incorporates the latest techniques for high production and lower costs.

This catalog in miniature is an example of our wide range of equipment and supplies. In addition to the famous Stevens Model C Barrel Machine shown above, we also design and build Automatic Rack Plating Machines to meet every requirement.

Pick out what you need—then get in touch with your local Stevens representative. He'll tell you what you want to know.

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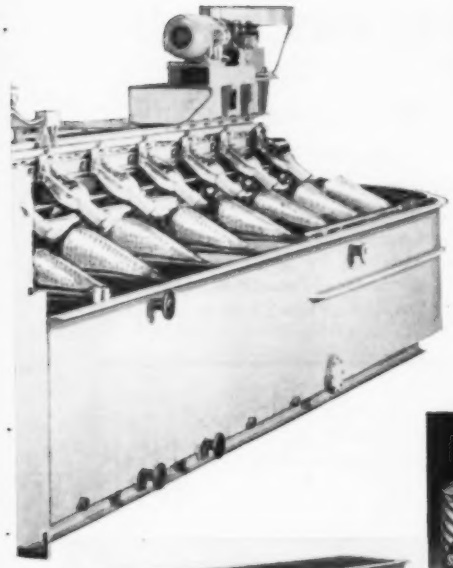

SILICON RECTIFIERS

The new Stevens line of silicon rectifiers represents a major advance in design, construction and performance. All new from top to bottom, they feature self-contained controls, hinged inspection doors, new, one-piece finned heat sink with non-aging silicon cells, built-in ventilation system, positive protection from overheating, overloading and short-circuiting.

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Lighter, stronger, longer-lasting polypropylene Stevalite oblique barrels tumble parts more effectively, give improved plate distribution. Designed for use on all Stevens Automatic Barrel Plating and Processing machines, they require no lids. Also available in Plastisol-covered steel.

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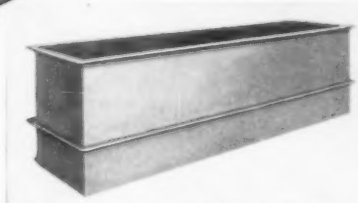
Stevens liquid and bar compositions are preferred by metal finishers for all buffing, polishing and coloring operations. Whether you require a heavy cut or extremely high color, there's a job-matched Stevens formula for the job.



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Stevens builds still tanks of steel, aluminum and stainless as well as special purpose tanks to meet specific needs. Complete Koroseal, neoprene and rubber tank lining facilities in three convenient locations.

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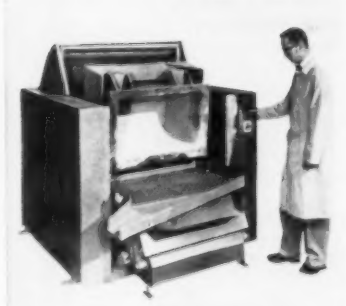

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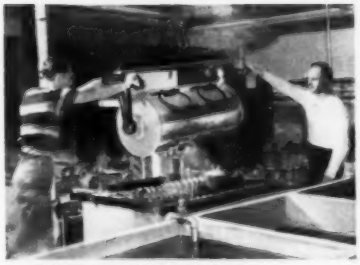

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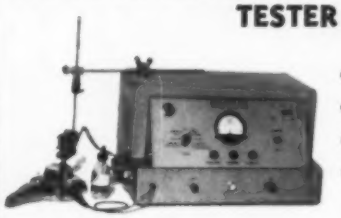

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PATENT ABSTRACTS

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Nutley, New Jersey

Copies of patents may be obtained by writing to Commissioner of Patents, Washington, D. C. Price 25 cents each.

2,962,125, 11/29/60—PLATING APPARATUS—J. Davis, assignor to The Udylite Corp., Detroit, Mich.

A lift apparatus for an electroplating conveyor is described.

6 claims, figure.

♦

2,962,427, 11/29/60—ELECTROPLATING PROCESS—L. Kosowsky, assignor to Columbia Broadcasting System, Inc., New York, N. Y.

Etch a stainless steel article anodically in a sulfuric etch solution which is then upwardly displaced with a copper solution of greater density than the sulfuric acid. The article is then made cathodic in the copper solution.

6 claims, figure.

♦

2,962,428, 11/29/60—CHROMIUM PLATING—F. Passal, assignor to Metal & Thermit Corp., Woodbridge, N. J.

Claim 1 reads: An aqueous bath for chromium plating comprising between 50 and 600 g/l of chromic acid and at least one complex ion selected from the class consisting of fluoaluminate, fluotitanate and fluozirconate ions, the ratio of chromic acid to said complex ion being between 50:1 to 200:1.

17 claims.

♦

2,963,140, 12/6/60—CONVEYOR—J. Barton, assignor to Frederic B. Stevens, Inc., Detroit, Mich.

A barrel type conveyor apparatus is described.

8 claims, figure.

♦

2,963,141, 12/6/60—CONVEYOR UNLOADER—C. Pellow and R. Pellow, Detroit and Dearborn, Mich., respectively.

A conveyor unloading means is described.

13 claims.

♦

2,963,384, 12/6/60—ALUMINIZING—C. Owen, assignor to Hubbard & Co., Chicago, Ill.

Use a fused salt bath of the following composition:

	(Per cent)
NaCl	35 to 55
KCl	35 to 55
Na_3AlF_6	5 to 20
K_2CrF_6	0 2 to 5

8 claims.

♦

2,963,409, 12/6/60—ANODIC COATING—E. Ramirez, assignor to Reynolds Metal Co., Richmond, Va.

Claim 9 reads: "The method of forming an anodic coating of high flexibility and dielectric strength upon an aluminum surface which comprise immersing the aluminum as anode in an aqueous

acid anodizing electrolyte consisting essentially of a mineral acid and from about 0.1 per cent to about 10 per cent by weight of a metal halide selected from the group consisting of alkali metal and alkaline earth metal halides and from about 0.2 per cent by weight to a percentage represented by the limit of its solubility therein of an aliphatic dicarboxylic acid of from 2 to 5 carbon atoms, and passing a current through said electrolyte at a current density above about 200 amp/sq ft.

11 claims.

♦

2,964,300, 12/13/60—PROCESSING APPARATUS—L., J. and F. Lisowski, assignors to Natural Products Co., Newport, Mich.

A tumbling holder for processing small parts is described.

11 claims.

♦

2,964,432, 12/13/60—METAL TREATING PROCESS—H. Francis and F. Roebuck, assignors to National Steel Corp., Delaware.

Material with a zinc coating can be made more corrosion resistant by treating with an aqueous solution containing zinc nitrate and chromic acid.

See also 2,964,433 on the same subject—27 claims and a figure.

11 claims.

♦

2,964,434, 12/13/60—PICKLING BATH—W. Coleman, assignor to Victor Chemical Works, Chicago Heights, Ill.

A method of pickling and inhibiting the rusting of a ferrous material consists of immersing in a pickling solution (H_2SO_4-H_3PO_4) of *p*H less than 1 containing a boron-phosphate inhibitor with P:B being 1:1 and not more than 17.3:1.

8 claims.

♦

2,964,453, 12/13/60—COPPER ETCHING BATH—P. Garn and L. Sharpe, assignors to Bell Laboratories, New York, N. Y.

Claim 1 reads: "A method of etching copper in a regenerable etching solution and simultaneously regenerating the same solution in the same vessel which comprises etching copper in an etching bath containing a metallic chloride capable of both being an etchant for copper and going from the oxidation state of its exhausted condition back to the oxidized state of its fresh condition and an excess of chloride ions, and simultaneously electrolytically regenerating the same solution in the same vessel having a cathode and an anode, said cathode having a surface area less than said anode so that a current density gradient is established between the cathode and the anode which causes cuprous and cupric ions to be reduced to a copper at the cathode and cuprous ions to be oxidized to cupric ions at the anode which, together with the cupric ions of the plating solution, are physically free to migrate to the cathode.

2 claims.

♦

2,964,883, 12/20/60—BUFFING MACHINE—J. Harper, Portland, Conn.

A buff-head assembly and conveying means is described.

9 claims, figure.

♦

2,965,110, 12/20/60—ELECTROPLATING MACHINE—D. Borodin, assignor to Wagner Bros., Detroit, Mich.

A plating conveyor is described.

24 claims, figure.

♦

2,965,519, 12/20/60—SEMICONDUCTORS—H. Christensen, assignor to Bell Laboratories, New York, N. Y.

For an electrically conductive contact material on Si and Ge, deposit a layer of gold (1500 to 10,000 Å), then bismuth trioxide (35 to 500 Å), then heat to form a Au-Bi alloy.

6 claims.

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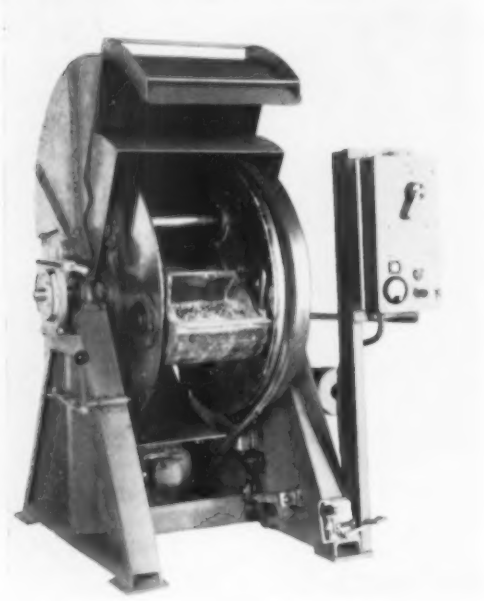
YOUR PLATING MAGAZINE QUESTIONNAIRE

So as to assure that PLATING MAGAZINE's classification of its subscribers by number, function and geographical location is constantly and consistently up to date for Audit Bureau of Circulations audit, a Return Sheet was recently issued to each subscriber internationally. It is revealing that nearly 50 per cent of such Return Sheets issued were executed and returned by subscribers within ten days of issuance, with the flow, of course, continuing. If you have not yet accomplished and returned yours, your cooperation in doing so promptly will be appreciated by AES and PLATING.

MIRROR FINISHES



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2,965,521, 12/20/60—PICKLING—H. Bomberger and M. Vordahl, assignors to Crucible Steel Co., Flemington, N. J.

To pickle Ti, Zr and alloys of each immerse in a solution containing 0.5 to 5 per cent of fluoride ions and 5 to 35 per cent of H_2O_2 at 100–190F.

4 claims, graph.

♦

2,965,523, 12/20/60—SCALE REMOVAL—J. Engle, assignor to Dow Chemical Co., Midland, Mich.

Alternately subject ferrous articles carrying scale to a phosphoric acid solution and an alkaline hydroxide—carbonate bath at 175 to 212F.

13 claims.

♦

2,965,551, 12/20/60—PLATING PROCESS—H. Richaud, assignor to Pechiney, Paris, France.

To coat with nickel, degrease and clean, make the anode in a bath of a nickel salt and a sulfate, thiosulfate, hydrosulfite, arsenite phosphite or hypophosphite, then plate nickel on the anodic layer.

16 claims.

♦

2,965,974, 12/27/60—DRYING MACHINE—W. Jackson, assignor to the Udylite Corp., Detroit, Mich.

A chute basket-type drying apparatus is claimed.

8 claims.

♦

2,966,427, 12/27/60—GAS PLATING—E. Breining, assignor to Union Carbide Corporation, New York, N. Y.

A method for plating a phosphorous-metal alloy by gas plating is described.

11 claims, chart.

♦

2,966,448, 12/27/60—PLATING ON ALUMINUM—T. Connor, assignor to General Electric Co., New York.

The method includes alkaline etching on a bath containing tartrate, immersion zinc coating from a zincate bath, then plating zinc on the article from the zincate bath at about 1500 asf.

3 claims.

♦

2,967,112 1/3/61—METAL REDUCTION—S. Kay and R. Ball, assignors to Pilkington Bros., Ltd., Lancashire, England.

A method and apparatus for causing deposition by chemical reduction by bringing the metal and reducing solutions together.

10 claims, figure.

♦

2,967,134, 1/3/61—COOKING UTENSILS—A. Scavullo, assignor to Legion Utensils, Inc., Jamaica, N. Y.

A vessel made of a sandwich layer of low carbon steel clad on both sides with 18:8 stainless steel is grooved near the base, stopped off then copper plated on the bottom and into the groove.

1 claim, figure.

♦

2,967,135, 1/3/61—PLATING HARD, BRIGHT GOLD—B. Ostrow, North Bellmore and Fred Nobel, North Valley Stream, N. Y.

Addition agents added to acid (2.5–6.5 pH) gold plating baths and claimed to provide hard, bright gold deposits. The addition agents may be alkylol-, alkylene-, and alkanol-amines and polymers thereof with 1 to 12 carbon atoms.

13 claims.

♦

2,967,136, 1/3/61—CHEMICAL BRIGHTENING OF ALUMINUM—A. Cybriwsky and N. Mostovych, assignors to Reynolds Metals Co., Louisville, Ky.

A sulfuric-phosphoric aluminum bright dip which can also be used with current as an electropolishing solution is described and graphs show the relative amounts of the two acids needed.

12 claims.

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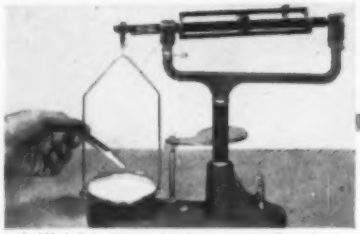
New "Direct-Route" Method

1 Just weigh required amount of sodium-copper or potassium-copper double salt.

2 Dissolve the desired double salt in water or plating solution.

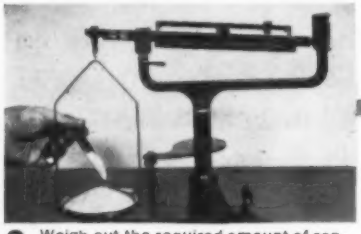
Laboratory demonstration shows how "direct-route" method saves time

Old "Indirect" Method



1 Weigh out required amount of sodium or potassium cyanide.

2 Dissolve the sodium or potassium cyanide in water.



3 Weigh out the required amount of copper cyanide.

4 Add copper cyanide to water and make a slurry.

5 Dissolve the copper cyanide slurry in solution of sodium or potassium cyanide.

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- **Sodium-Copper Cyanide Double Salt**
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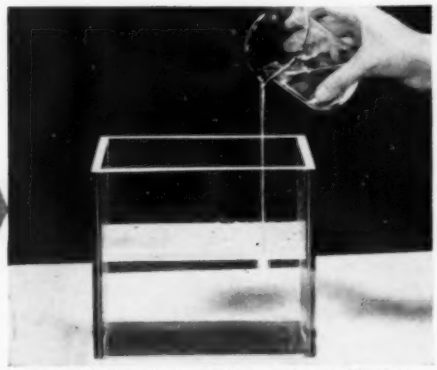

3 Add directly to plating tank—no filtering necessary.

...avoids errors.

6 Add solution through a filter to plating tank.

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OR
POTASSIUM-COPPER CYANIDE

SAVE TIME AND REDUCE HANDLING...By using one Du Pont copper cyanide double salt instead of two separate chemicals, you eliminate several steps usually required to dissolve copper cyanide. Just weigh out the Du Pont double salt and dissolve it in water or plating solution. A "direct-route" process! (Compare old and new methods at left.)

AVOID WASTE AND MIXING ERRORS...because active ingredients are in the proportions usually required. This simplifies making and replenishing bath . . . prevents waste resulting from undissolved copper cyanide.

INCREASE CONVENIENCE AND SAFETY...With just one salt to dissolve you minimize handling steps. This means greater convenience—more safety.

Du Pont sodium-copper cyanide double salt and potassium-copper cyanide double salt are white, crystalline and readily soluble. They are made from ingredients of highest quality and purity —Du Pont copper cyanide, sodium cyanide and potassium cyanide.

SIMPLIFY CALCULATIONS...Balanced composition of Du Pont double salts makes it easy to determine amounts required for make-up or replenishment. (1 oz. potassium-copper cyanide double salt is equivalent to 0.26 oz. copper, or 0.37 oz. copper cyanide; 1 oz. sodium-copper cyanide double salt is equivalent to 0.29 oz. copper or 0.41 oz. copper cyanide.)

SODIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	28.7% min.	29%
"Free" sodium cyanide	0.4 to 2.0%	1%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	0.01%

POTASSIUM-COPPER CYANIDE DOUBLE SALT

	SPECIFICATIONS	TYPICAL ANALYSIS
Copper	25.8%	26.3%
"Free" potassium cyanide	1.25% to 3.0%	2.9%
Lead	7 ppm. max.	Less than 1 ppm.
Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
Insolubles	0.01% max.	Trace

Both potassium and sodium double salts are shipped in convenient moisture-resistant 100-lb.-net fiber containers.

For further information or Technical Service call your Du Pont distributor or your nearest Du Pont office, listed at left.

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BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

TRADE LITERATURE

L—601. FILTERS—Centrifugal or self priming, positive displacement pumps handle capacities from 200 to 10,000 gph in Udylite Detroit Line of high area, low pressure filters, originally designed for plating solutions but since adapted to many other industrial reclamation projects. A four-page illustrated brochure made available by The Udylite Corp. lists specifications of each side-opening filter, built for easy maintenance and maximum removal of contamination from all kinds of plating solutions and the efficient filtration of many other liquids. Special models are engineered and constructed to individual specifications.

L—602. CLEANING CHEMICALS—A 14-page booklet, "Chemicals for Ultrasonic Cleaning," has been issued by the ultrasonic power division of Branson Instruments, Inc. It gives information on physical properties of most commonly used cleaning chemicals, as well as suggested applications, working temperatures, and procedures. By following the recommendations in Bulletin S700, users of ultrasonic equipment should be able to select the chemical best suited for a specific cleaning problem.

Fourteen different types of cleaning media are tabulated, divided into two main groups—aqueous solutions, and solvents. Accompanying technical information includes such useful data as concentrations, operating temperatures, safety handling measures, and proper uses.

L—603. METALLIC FLUOBORATES—Several technical bulletins available from Harstan Chemical Corp. give the properties and applications of metallic fluoborates. Full details and preparation instructions are included in bulletins. Specially advantageous for those employing fluoborate plating baths.

L—604. FILTRATION EQUIPMENT—Bulletin No. 100 issued by Pressurized Filtration, Inc., recently formed to manufacture and sell in the USA and Canada products of the Braithwaite Equipment Ltd. of Luton, England, describes a new line of filtration equipment for water soluble coolants.

L—605. POWDERED STRIPPER—A new dry powder for immersion stripping nickel from brass and copper is fully described in Technical Data Sheet No. 116, a three-page usage and instruction sheet prepared by MacDermid Incorporated.

Called Metex Nickel Stripper BR, the product is said to provide a safe, fast, low-cost method of reclaiming nickel-plated, copper-base alloys and copper-plated die-castings.

Surface finish is claimed to be unaffected by Nickel Stripper BR, and little or no buffing is required before parts are re-plated. The product is competitive in price with anodic-sulfuric acid stripping.

L—606. SPRAY NOZZLES—Bulletin 106 describes the complete Spraying Systems Co. line of spray nozzles and accessories specifically used in the metal finishing field. Reference chart lists applications and types of nozzles used. A complete spray nozzle reference manual on washing, rinsing, fogging or wetting, coating and related operations.

L—607. ALUMINUM PROCESSING—"Wyandotte Products for Aluminum Processing" is the title of a colorful 4-page folder made available by J. B. Ford Division, Wyandotte Chemicals Corp. The folder covers etching, cleaning, desmutting, paint stripping, barrel finishing, brightening, paint preparation, deoxidizing.

Featured products include Wyandotte Mil-Etch for decorating etching and Wyandotte Aldet, a new non-silicated companion product for cleaning prior to etching.

L—608. COATINGS—Four-page folder available from Service Products Division, Johnson's Wax describes 18 special industrial coatings for all types of metal-using industries, designed for one or more of the following uses: (1) product protection, (2) improvement of appearance, (3) mold or die release, (4) dry lubrication. Problem-solving coatings described fall in four general chemical categories—wax emulsions, resin emulsions, solvent-base waxes and self-polishing solvent-base waxes and resins. Description includes data on methods of application, coverage, drying time and characteristic uses on aluminum, brass, copper, cast iron, magnesium, steel, chromium and on surfaces of other materials.

L—609. RUST REMOVER—Data sheet available from E. F. Houghton & Co. describes Rust Remover 3503 said to remove rust, give iron phosphate coating, clean light soil. Versatility said to save time, labor costs; reduce inventory and handling.

L—610. ACTIVATION TREATMENT—Nickel plated parts can now be activated prior to chromium plating by using Clepo 199-R according to Bulletin 261 of Frederick Gumm Chemical Co. Clean water-break-free parts are immersed in a dilute sulfuric acid solution to which is added 4–8 oz/gal Clepo 199-R for 15–20 seconds. After rinsing, the parts are ready for chromium plating. The prepared solution insures more complete chrome coverage and also improves the throwing power of the chrome solution by activating normally passive areas of nickel deposits. This simple operation can be closely controlled to insure uniformity in its action.

More detailed information is given in Technical Bulletin 261.

L—611. CHEMICALS—A catalog containing technical descriptions and specifications on its major products is available from Fidelity Chemical Products Corp.

The publication presents directions for use and covers technical data on a variety of chemicals. Described are bright dips and descalers for high nickel alloys, stainless steels, cold rolled steels, copper and brass alloys and a variety of other metals; chemical wire strippers; stop-offs for plating and painting; and paint strippers for epoxys, vinyls, baking enamels and lacquers.

Also included is information on strippable coatings, alkaline metal cleaners, burnishing compounds, and spray booth compounds.

L—612. PRINTED CIRCUITS DRAFTING CHART—A reprint of By-Buk Company's printed circuit drafting aids chart is now available free.

This is a copyrighted six-page illustrated table which includes all of the pre-cut pressure sensitive shapes and narrow tapes required to make paste-up printed circuit drawings that will conform to military specifications, together with many new non-military configurations.

L—613. VACUUM METALIZING—"New Developments In Vacuum Metalizing" is a 4-page brochure of Bee Chemical Co. describing metalizing coatings systems which may be applied by spraying, dipping or flow coating to thermoplastics, thermosetting plastics, metals and glass. Base coats applied before metalizing and top coats and back-up coats for use after metalizing are detailed.

protection for metal surfaces

- **FASTER**
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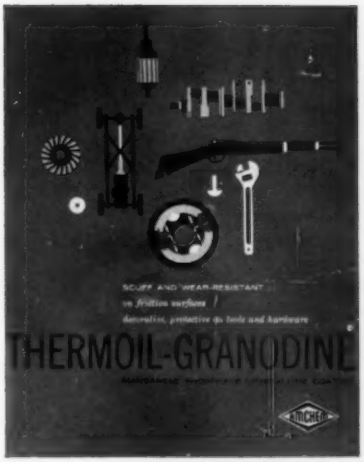
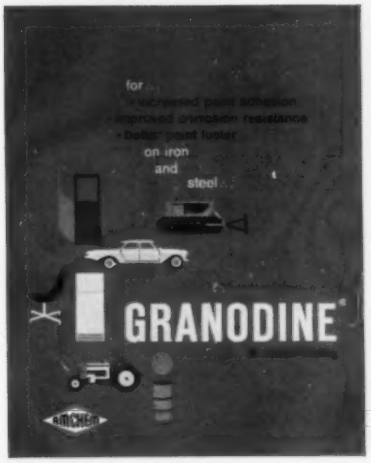
with Amchem chemicals and processes!



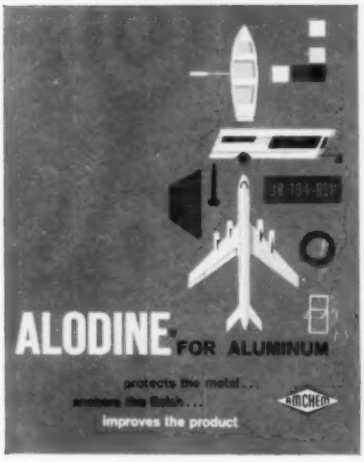
THERMOIL-GRANODINE*

A crystalline manganese iron phosphate coating to improve the wear-resistant and antigalling characteristics of gears, piston rings, camshafts, cylinders and other rubbing parts. Also ideally suited as a decorative and protective coating on tools, hardware and ordnance items—wrenches, drill shanks, screwdrivers, hinges, gun barrels, gun bolt parts and many other products. Write for Bulletin 1481.



GRANODINE **

Zinc and iron phosphate coatings to provide corrosion protection and an excellent paint base on iron and steel products of all types. Granodine converts metallic surfaces to a nonmetallic phosphate coating of the proper texture for inhibiting corrosion and increasing paint adhesion for subsequent paint finishing. Granodine adds durability of outstanding characteristics to treated products. Write for Bulletin 1380B.



ALODINE ***

Amorphous chromate coatings that become an integral part of the aluminum being treated to protect painted and unpainted surfaces, form a durable and tenacious bond for paint, permitting subsequent forming without damage to the finish. Widely used on aluminum parts and products—strip or sheet stock, aircraft parts, all types of building products, wrought, cast and forged aluminum and many others. Write for Bulletin 1424C.

Amchem is a registered trademark of

AMCHEM PRODUCTS, INC.

(Formerly American Chemical Paint Co.)

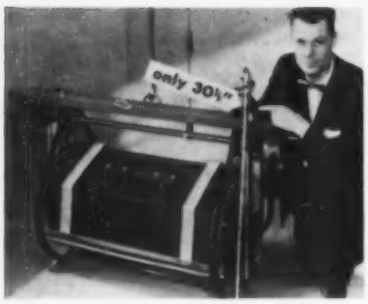
AMBLER, PA. • Detroit, Mich. • St. Joseph, Mo. • Niles, Calif. • Windsor, Ont.

*Amchem's trademark for its crystalline manganese phosphate coatings.

**Amchem's trademark for its conversion coating chemicals used to produce phosphate coatings on steel.

***Amchem's trademark for its conversion coating chemicals for aluminum.

EQUIPMENT AND SUPPLIES

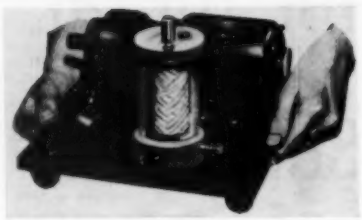


E—601. BARREL SUPERSTRUCTURE—A recent advance in equipment design to modernize and simplify barrel plating for metal finishers is the new "Low-Boy" superstructure for all makes of barrel equipment, developed and manufactured by The Singleton Co. The new unit is reported to be the first of its kind to enable platers to convert their present equipment of all makes to latest belt-drive and inverted-V contacts without obsoleting existing installations. All features are covered by U. S. Pat. 2,886,505.

All Singleton Superstructures are built to operate in all solutions, acid or alkali. Hanger arms are coated with a special-formulation plastisol offering higher chemical, thermal and physical resistance.

E—602. BELT COMPOUND—Grav-i-Flo Corp. announces Belt-Life, a new compound, developed for cleaning abrasive polishing belts and wheels. Belt-Life contains an ingredient which is claimed to extend the life of the belt or wheel by cleaning the abrasive surface, by preventing it from loading with metal, and by maintaining its high cutting efficiency.

E—603. FILTER SYSTEM—A complete "Miniature" Filter System has been recently introduced by Sethco Mfg. Corp. The Sethco Model LAI-1 combines the miniature "full-view" lucite filter chamber with a miniature epoxy centrifugal pump. Powered by a 1/40 hp continuous duty motor, all the components are mounted on an 8 by 9 in. linen phenolic panel. Since it comes complete with filter tube, vinyl hose and electric cord, it can be plugged into



any 2 or 3 wire 110 volt ac outlet for immediate operation. Capacity is 180 gph on open pumping and this model will readily keep a ten-gallon tank vigorously agitated or filtered to sparkling clarity.

E—604. OXIDE REMOVER—Electroplating onto copper and copper alloy printed circuits is said to be substantially improved by Deoxyde which reportedly removes oxides, oils, fingermarks and similar plating deterrents, through a simple dipping operation.

According to the manufacturer, The Meaker Co., subsidiary of Sel-Rex Corp., the new formulation cleans without affecting plating resists, or etching copper cir-

PPI TITANIUM METAL PLATING ACCESSORIES

Made of Durable, Lifetime Titanium Metal That Will SAVE YOU TIME and MONEY

For Use in . . .
Nickel Plating Solutions

Maintenance Free . . .
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Durable-Lifetime . . .
• TITANIUM ANODE HOOKS

Longlasting . . .
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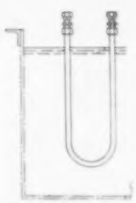
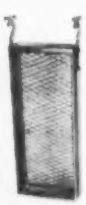
"Scrap-Saver"
ANODE BASKETS


HEATING COILS

PAT. PEND.
ANODE HOOK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ANODE BASKET

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PLATING COATINGS

PC-7 AIR-DRY COATING . . .
The standard of the plating industry for 15 years. Requires no primer, no baking. Ideal for racks, fans, exhaust systems, patching plastisol coatings, tank patching, and other difficult areas and equipment requiring corrosion protection.

PC-21 PLASTISOL GENERAL PURPOSE COATING . . .
The ultimate bake-on Vinyl coating for permanent protection of racks, tanks, pipe and equipment. Provides coating thickness to 3/16" with one application, and is immune to effects of all plating chemicals.

SO-8 STOP-OFF LACQUER . . .
Won't creep when applied, won't allow underplating, strips like magic. How much easier can selective plating be made?

V-10 AIR-DRY PERMANENT COATING
Another unique Munray development of a modified Vinyl formulation to allow easily applied protection to large surfaces, such as complete walls, large processing equipment, hoods, and ducts, tank exteriors.

Write for catalog

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SPECIALISTS IN ENGINEERED PLASTICS
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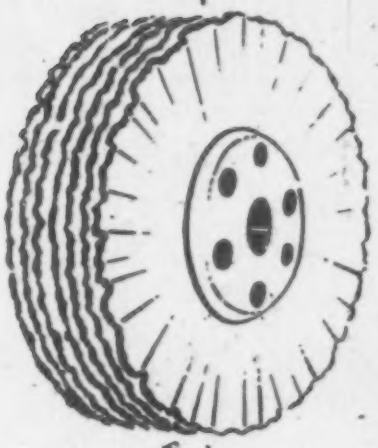
THIS IS Type 190

FABRIC ENGINEERED by Milliken

BUFF CLOTH

Work Horse of the Industry for Cut and Color Work



...the cloth to specify for general use and long life.

Other Milliken buffing fabrics include:

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A softer fabric for jobs between cut and color and fine coloring.

Red line
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A rugged cloth for heavier work involving a certain amount of metal removal.

Wearon
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Newest and toughest. Cuts down fins and flashings, buffs irregular shapes, yet resists fraying.

Specify Milliken Buff Cloths, *trade-marked so you're sure.*

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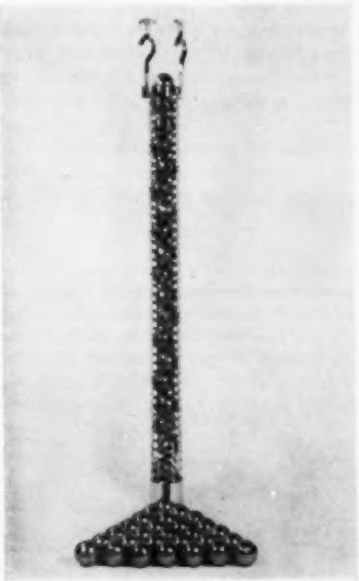
cuits, thus promoting reject-free production of subsequent electroplating operations.

It is packaged in a specially-designed polyethylene "cubitainer," from which it is easily poured to mix with equal parts of water in a suitable processing vessel. Printed circuits are said to be effectively cleaned by dipping for 30 sec to 5 min, depending on size and configuration of circuit design.

E—605. NICKEL BALL ANODES—A new concept in nickel plating has been claimed by the Univertical Corp. of Detroit, Michigan. According to Charles T. Walker, president, the new development involves the use of nickel ball or beehive type anodes, inserted in a perforated titanium anode basket as shown in the photograph. The commercially pure titanium anode basket allows the passage of direct current in the plating solution while being chemically inert to attack by the solution.



Corrosion tests in almost all types of nickel plating solutions have shown absolutely no corrosion after 400 hours in the solutions at a constant temperature of 150F. Titanium baskets are *not* recommended for use in fluoride or fluoborate type plating solutions.

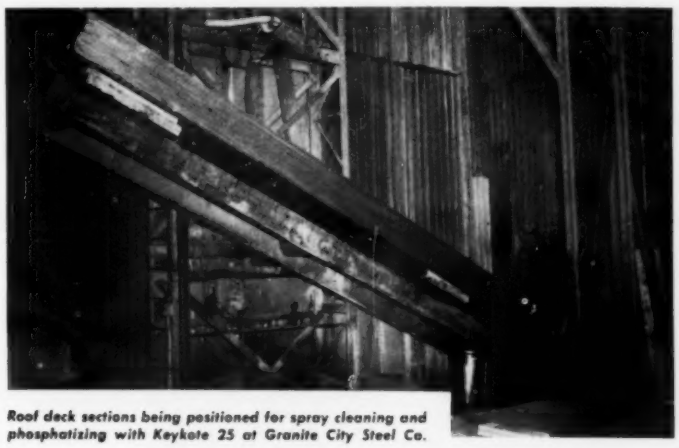
Some advantages of the nickel ball anodes are: Constant anode area; easy replenishment; eliminates anode bags; reduces maintenance; eliminates scrap loss by completely dissolving; minimizes iron and copper contamination, and; the titanium baskets can be used indefinitely without replacement.

E—606. VINYL FINISHES—New multicolor, spray-on vinyl finishes for a wide variety of consumer, architectural, and industrial products have been announced by Metal & Thermit Corp. A two-step

system, decorative vinyl finishes in unlimited color and with controllable texture can be applied to either phosphated steel or aluminum by conventional or electrostatic spray techniques, according to M & T.

This new system permits application of a tough, multi-colored vinyl finish to products after fabrication, producing savings over methods which start with pre-laminated or pre-coated sheet metal.

In application, a wet film base coat of the desired undertone color is developed with three or four spray passes on the part to be coated. Immediately following this, and while the part is still wet, three or four spray passes of topcoat are applied. Color texture begins to form almost immediately on this second application, and continues to form during the specified 15 to 30-min flash off period. The normal bake schedule calls for five minutes at 200–250F, followed by 15 minutes at 300–325F. Texture is a function of viscosity and wetness of base and topcoats, which can be controlled within close limits.



Roof deck sections being positioned for spray cleaning and phosphatizing with Keykote 25 at Granite City Steel Co.

Granite City Steel Co. relies on Kelite KEYKOTE® 25

for superior corrosion protection in the manufacture of their ribbed steel roof decking of noted high quality. Finishing is accomplished in one of the world's largest conveyor systems for paint preparation and painting.

Keykote 25 is a powdered composition which produces dense complex phosphate coatings from water solutions. While not an iron phosphate, it competes in that class. It embodies iron for ductility, zinc for galvanic protection, manganese for hardness and ferromolybdate for passivity. The result is superior performance at low cost.

Keykote 25 baths produce little or no sludge or scale. Solutions are easy to control and a single material is used for make-up and replenishment of the bath.

Application is by one to six stage spray washer, immersion, or steam phosphatizing methods.

For further information write the nearest Kelite Office listed below. Ask for Keykote 25 bulletin F21.

U. S. PATENT NOS. 2,957,909, 2,826,517, 2,985,312. OTHERS IN PROCESS. ALSO PATENTED IN CANADA, AUSTRALIA, AND GREAT BRITAIN.

KELITE CORPORATION

● Los Angeles 12 ● Chicago 45 ● Berkeley Heights, N. J.

In Canada: S. F. LAWRASON & CO. LTD.

E—607. ANTI-TARNISH—Lea-Ronal Inc., is marketing a new anti-tarnish known as No-Tarn "EC". It is said to impart high tarnish resistance to non-ferrous metals, such as electroplated brass, copper, as well as solid brass, and other copper-base alloys. Work that is electroplated in cyanide solutions has a tendency to stain and spot out, when such plated parts are treated in No-Tarn "EC", entrapped cyanide is neutralized and spotting out materially reduced.

No-Tarn "EC" is a dry salt mixture that is used in an aqueous solution with electric current. It is marketed in standard type containers in 50, 100, and 500 lb lots.

E—608. ALUMINUM ETCHANT—A new economy aluminum etchant that is highly alkaline for fast etching and formulated to prevent scale has been announced by The Diversey Corp.

The company reports that its new Diversey D-Etch assures outstanding performance under a wide variety of conditions. The product, a white, uniform and free-flowing compound, is soluble in water and is used in concentrations of 4 to 8 oz/gal.

The new etchant contains special chelating agents to prevent sludge and scale from aluminum oxide and hard water salts, it is reported. This eliminates expensive descaling of tank and heating coils.

E—609. SPRAY TIP—A new type of airless paint spraying and coating tip has been announced by Spraying Systems Co. for the internal surface finishing where inside areas must be sprayed. These 9018-TC Tips are supplied with single or double orifice inserts and project a flat spray at right angle to the nozzle. The orifice inserts are made of tungsten carbide and are held in place by individual retainer nuts. By loosening the retainer nut, each orifice insert may be rotated to any desired position on its own axis for adjusting the plane of the flat spray relative to the work.

E—610. NICKEL STRIPPER—A nickel stripper, claimed not to attack steel, copper, brass or solder, has been announced by Enthone, Inc., subsidiary of American Smelting and Refining Co. Called Enstrip NP, it can be used to strip nickel from steel, nickel from copper and brass, or nickel from assemblies made up of combinations of steel, copper, and brass components.

Enstrip NP is said to dissolve nickel by simple immersion at room temperature; elevated temperatures may be used for faster stripping. It is claimed that the stripping solution does not contain cyanides, presents no cyanide waste disposal problem, and is a stable solution which does not decompose when left idle for long periods of time.

The product is furnished as two liquid concentrates, Enstrip NP-1 and Enstrip NP-2, which are mixed together with water to make up the stripping solution.

E—611. ANODE—Heil Process Equipment Corp. has developed and introduced its new HS-32 plating anodes.

These new Heil HS-32 anodes are manufactured of a new, special lead alloy developed for use with high fluoride-ion plating solutions. They have been approved by manufacturers of the fluoride-ion plating solutions for use with these new solutions. In addition to other advantages, these anodes reportedly have superior current conduction properties after idle or shut-down periods.

General Plate
RHODIUM PLATING SOLUTION

Provides Extra Brilliant Finish
Protection Against Corrosion and Tarnish

General Plate Rhodium Solutions are widely used by platers for both industrial and decorative plating. Their experience proves that in applications requiring brilliance, corrosion and tarnish protection and adherence to base metal, General Plate solutions give unexcelled results at no greater cost.

Write for Bulletins PLA-4 and PLA-11 for complete details.

You Can Get These Services When You Use GENERAL PLATE Rhodium Plating Solutions:

- Analytical service for electroplating bath control
- Testing — results furnished promptly
- Competent consultant staff and comprehensive laboratory facilities
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A CORPORATE DIVISION OF TEXAS INSTRUMENTS INCORPORATED

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A Warning To Prospective Buyers of Used Plating, Polishing or Painting Equipment

Don't Invest A Single Dollar Before Checking These Important Pre-Purchase Pointers

If you are considering the purchase of used or rebuilt equipment for your plant, experience has taught us that it is either because you are interested in the cost savings involved as compared to new equipment, or delivery of new equipment is a problem. Whichever your motive may be, you would be wise to weigh the possible pitfalls of this type of investment before you have course to regret your decision to "buy it re-built".

Selecting Your Source... The First, Most Important Step

Over the past few years literally dozens of used and rebuilt equipment "dealers" have sprung up who "specialize" in metal finishing machinery. Many of these concerns are fine, reputable organizations, others are merely brokers with no inventory on hand, without rebuilding facilities and financial responsibility. To the prospective buyer who investigates before he invests and is not misled by what may appear to be a bargain, these "companies" simply don't rate as sources to be taken seriously. For the sake of comparison, check the assurances that we offer here at J. Holland & Sons, Inc.

Reputation... Does It Really Mean Anything?

We think so. Since 1905 we have supplied metal finishing plants in 41 states and 16 foreign countries with every conceivable type of rebuilt equipment from air compressors to zinc plating installations. Each unit shipped out of our plant is completely rebuilt and accompanied by a meaningful guarantee. Our customers have learned that we deliver what we promise at the price we promise.

Without the men and machines for legitimate rebuilding operations, without the plant . . . used equipment usually ships out as old equipment with a new coat of paint and a shiny name tag. Here at J. Holland and Sons, Inc., 7500 square feet of our plant are devoted to a completely equipped machine shop and electrical shop. These departments are expertly staffed with over 30 men, many of whom have been with us for over 20 years. In many cases equipment we sell is not as "good as new"... it's "better than new."

Inventory... Significant?

Only when you need something in a hurry . . . which seems to be the case with most customers. We have 80,000 square feet of warehouse space stocked with over 6200 different items ranging from dip baskets to twelve station automatic plating units. This inventory is considered to be the most complete single stockpile of metal finishing equipment in the world.

Service... More Than Just a Word?

The record speaks for itself on this score. Our engineers have supervised installations wherever equipment was sold and whenever their help was requested. Since a machine is, after all, only a machine, and operating problems do arise, our service policy is simple . . . we will fix it in the customer's plant or accept its return for repair.

Customer List...Impressive?

As proud as we are of the hundreds of large, blue chip companies we have worked with, the relationship we enjoy with the small shop owner pleases us even more. To the "little man", buying equipment for his plant is a demanding, almost personal, process. The fact that so many have seen fit to deal with us is the best possible evidence of the values we offer.

Credit Terms...Realistic and Easy To Meet?

Oftentimes the need for equipment arises before the ability to buy on open account. To cash-short customers we offer extremely attractive terms which many times allow the investment to actually pay for itself out of savings. You will find us easy to deal with when it comes to setting up a payment plan to suit your convenience.

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A Safe, Reliable Source For Rebuilt
Plating, Polishing and Painting Equipment

J. HOLLAND AND SONS, INC.
476 KEAP STREET • BROOKLYN, NEW YORK

I'm interested
- ☐ Have your representative telephone
- ☐ Send me your new folder describing your facilities and listing rebuilt equipment now in your inventory.

NAME:_____
TITLE:_____
COMPANY:_____
ADDRESS:_____

CALL FOR ACTION TO STIMULATE RECOVERY

Clyde H. Rheem, President of the Udylite Corporation, has thoughtfully sent us a statement that he recently presented to the members of Udylite's Management team and which he titled "A Program for Progress". PLATING MAGAZINE is happy below to share a portion of it with its readers.

For practically a full year now, the headlines of the morning papers have made a poor side dish for your toast and coffee. You have read about the increasing rate of unemployment, the falling rate of national growth, about higher prices and lower profits, about regression and recession and other types of crises in our national economy. And if you are like any other member of business management, this talk disturbs you and makes you wonder a little bit as you make your way to work.

As men of management we have willingly accepted the leadership. We have willingly joined the ranks of men who, like ourselves, determine how business can best serve the needs of the people of this country. Now *we* are faced squarely with the question: What are we going to do about this deadly state of mind faced by our nation and our business community?

One answer—and I believe a valid one—has come from a man on our own management team. Just a few days ago Chet Clark suggested to me a simple, yet purposeful program that will place the economic situation of ourselves, our company and our country back in its proper perspective.

You may be apprehensive about spending your money on the new car you had planned to buy—on signing the mortgage for the new homestead you've been looking forward to having for years—on taking that trip that you'd really like for this year's vacation. You may comprehend all these apprehensions as evidence of some unspoken kind of insecurity about your own job.

Without realizing it, we have let ourselves—not only here at Udylite, but all throughout the country—be drawn into a situation from which it becomes harder and harder to extricate ourselves.

But let's look at it in another light. Because the purchases we postpone today mean fewer jobs in the industries we supply . . . fewer orders on our own order books . . . fewer jobs in our own plant . . . we are working ourselves deeper and deeper into more of the same kind of apprehension that started this cycle in the first place. It promises to rob us—our personal selves, our industry and our nation—of vitality and confidence.

Obviously we don't want this kind of thing to happen. Nobody does. As men of management, it is our responsibility to shape the course of events. We exert the power we have earned to make things happen, not to permit things to happen to us. And the program resulting from Chet's suggestion offers a guide to solving today's particular problem.

What, then, am I asking of you business leaders here at Udylite, and all business leaders throughout the whole U. S. economy? Simply this: I am proposing that we start now the recovery program for the economy by our own action.

I am going to ask you to show your vitality and confidence by proceeding with those purchases you were planning on making . . . by buying the new car and appliance . . . by signing the mortgage . . . by taking the vacation. Pour the fruit of your labors back into the wealth of the nation. Enjoy the benefits you deserve unhampered by an unholy spectre of fear for the future.

This is the surest way of guaranteeing the security of your own job—which really may be what is haunting us all. *By making jobs for others we make job security for ourselves.* It is as simple as that, and it works as quickly as that.

We would like to see this program spread to your friends, to our suppliers, to the other industries here in Detroit and, in fact, throughout the entire nation.

* * *

I mentioned a second part to the program being proposed initially to you today. That is, to spread this gospel as far and as wide as you can. You will be interested to know that I am sending a copy of this talk with the Udylite plan for progress to the presidents of leading corporations in the country. In a covering letter there is a request that they encourage their own management teams to take the same action I am asking you.

Will you, then, convert others to it, and ask them to serve as missionaries as well? This includes your friends and neighbors, your grocer and milkman—anyone who has ears to listen to your voice. It is through concerted efforts on the part of all confident men in the country that this program can really succeed . . .

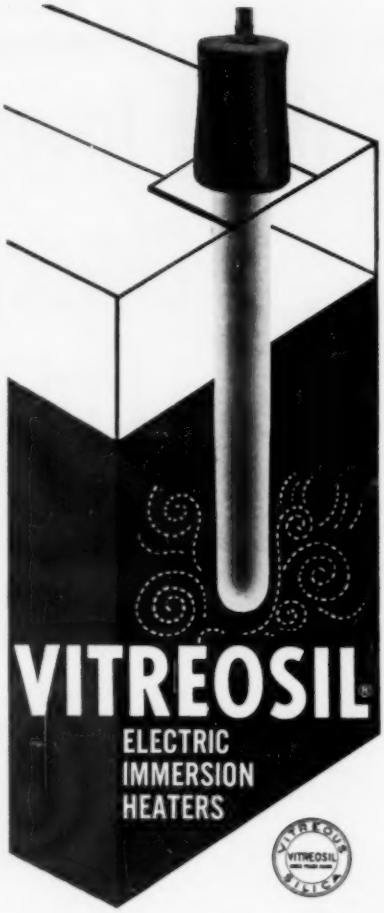
Consider this program thoughtfully—seriously. Discuss it at home and with your fellow employees. Then act! Don't hesitate any longer. Get out and show your confidence with your purchasing power and revitalized objectives, letting your confidence rub off on every friend and acquaintance you know.

KAYKOR NOW AN INDEPENDENT COMPANY

Kaykor Products Corp. has purchased the Kaykor Industries Division of Kaye-Tex Manufacturing Corp., and is now being operated as an independent company.

Kaykor Products Corp. produces a variety of vinyl, styrene, and other thermoplastic sheet laminates, for use in corrosion resistant applications.

J. L. Huscher, president, is the only active officer in the new corporation, and previously had managed the Kaykor operation.



VITREOSIL heaters are **pure fused silica** . . . ideal for heating acid pickling and electro-plating solutions and other acid baths. VITREOSIL Electric Immersion Heaters can be used with phosphoric acid **at temperatures up to 200°C** and with certain cyanide baths under controlled conditions. Besides immunity to extreme chemical, electrical, and thermal conditions . . . besides offering exceptional characteristics, VITREOSIL heaters feature:

- **Increased heat transfer per unit area**
- **Greater resistance to chemical attack**
- **Molded rubber cap for efficient sealing and simple installation**
- **Ground wire inside the sheath for additional electrical protection**
- **Markings for minimum safe immersion depth**
- **Outer silica sheath easily replaceable**

See our ad in Chemical Engineering, Electronic Engineers Master and Electronic Designers' Catalogues.

Write for complete, illustrated catalog.

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Quick Reference Finishing Guide to Plating and Abrasive Finishing

Buffing · Polishing · Brighteners and Addition Agents
Satin Finishing · Electroplating · Burring · Lapping · Accessories

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Main Office and Laboratory:
130-19 180th St.
Jamaica 34, N. Y.

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LEA MFG. COMPANY OF ENGLAND LTD.
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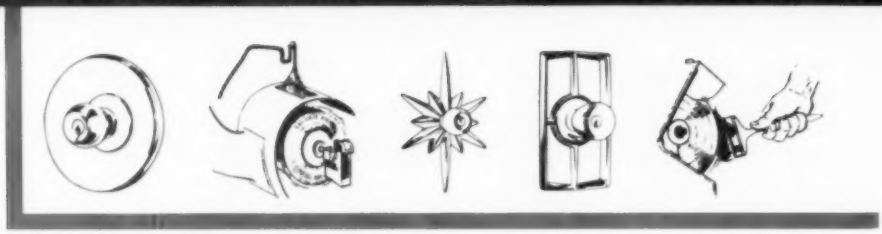
Derbyshire, England

ABRASIVE FINISHING COMPOSITIONS and OTHER FINISHING SPECIALTIES TO HELP YOU SOLVE YOUR PRODUCTION LINE PROBLEMS IN

BUFFING • POLISHING • BURRING • LAPPING • SATIN FINISHING



SATIN FINISHING — BURRING — POLISHING COMPOUNDS

LEA COMPOUND — industry's pioneering greaseless abrasive compositions for burring, buffing, satin finishing, and flexible polishing; contains abrasives ranging from sharp, fast-cutting grits to fine, soft powders for delicate finishes.

LEA PLASTI-BRADE — flexible, fast-drying, liquid abrasive, burring, polishing and satin finishing compositions, available in a wide range of abrasive grit sizes.

LEABRAMENT — greaseless, non-flammable, quick-drying, liquid abrasive for burring and polishing; can be sprayed or brushed on wheels.

BRIGHT BUFFING COMPOSITIONS

LEAROK — fine abrasive compositions with "no free grease" designed primarily for buffing or coloring pieces which involve cleaning difficulties; does not pack up in recesses and ornamentations.

LEA LIQUABRADE — clean-working, fast-cutting and mirror-finishing liquid buffing compounds, providing in effect continuous operations and substantial economies in compositions and buffs; clean and safe, non-flammable, non-explosive; many abrasive types and grain sizes for all non-ferrous metals, steel, stainless alloys, and plastics.

LEA LAPPING PASTE — micron size controlled abrasive paste for accurate and fine surface finishing.

LEA LINT-OFF — an anti-static solution for neutralizing static charges on plastics and other non-metallic surfaces.

ADHESIVES and CEMENTS

AD-LEA-SIVE — glue-base adhesive for sizing buffing and polishing wheels to improve application of Lea Compound, or loose abrasives; available in bar form.

LEA PLASTI-GLUE — fast-drying, flexible liquid adhesive, without abrasives, for preparing polishing wheels and abrasive belts.

LEA GRIPMASTER — high bonding strength cement for polishing wheels and belts; used in setting up longer lasting polishing wheels and belts for both ferrous and non-ferrous metals.

POLISHING WHEEL and BELT LUBRICANTS

LEA LIQUALUBE — water soluble liquid lubricant for polishing wheels and belts; can be sprayed or brushed on.

LEA LUBAR — bar form lubricant for polishing wheels and belts where glazing is not a problem.

cLEAn GRAIN LUBAR — special bar form lubricant to eliminate glazing on polishing wheels and belts.

BRIGHT PLATING PROCESSES and ADDITIVES

LEA COPPER-GLO — (with LEA-RONAL Bright Copper Process)

COMPANION PROCESSES:

Q-STRIKE
Q-LEVEL
CUPRALL

See Lea-Ronal ad for details of these processes.

PLATING ROOM ACCESSORIES

LEA ANALYTICAL METHODS — plater's short cut methods for analyzing plating solutions.

LEA LECTROMAG — portable electrical instrument for measuring the thickness of non-magnetic coatings on carbon steel and iron.

LEA KROMSAVERS — mist preventive for chrome and other plating solutions.

LEATARDENT — anti-stain dip emulsion; prevents staining and tarnishing of plated surfaces.

LACQUER ROOM SPECIALTIES

LEA COLDSTRIP — a room temperature stripper for enamels and lacquers.

LEA SYNSTRIP — high speed stripper for synthetic enamels; leaves non-ferrous surfaces smooth; no etching; especially effective in stripping epoxy resin coatings.

LEA-RONAL ELECTROCHEMICAL PROCESSES

Lea-Ronal offers the plating and other electrochemical process industries the most complete line of plating processes available in this country, if not in the world. New Processes are frequently developed and put on the market. Existing processes are constantly field-studied for ways of improving them. Field and laboratory technical service available including process evaluations.

PRECIOUS METAL PROCESSES — GOLD

AURO GLO 4 — an acid type bright ductile, easily controlled gold process; designed for electronic and allied uses. Hard, porosity free bright deposits.

AURALL — an all-inclusive lustrous 24K acid gold bath, for the electronic and allied industries; simple to operate, stable process; excellent substitute for cyanide gold.

AURO GLO 12 — a modification of Auro Glo 4 where hardness of 350-400 Knoop is desired. Produces hamilton colored shade, ideal for jewelry and allied uses.

AURO GLO HS — a neutral, zero free cyanide, bright high speed process. Rates of Deposition of 0.003" per hour readily obtained from a low concentration bath.

AURO GLEAM 24.00 — an entirely different acid type bath producing 100% pure bright gold deposits —no alloying elements.

PRECIOUS METAL PROCESSES — SILVER

BRIGHT SILVER — produces bright, hard tarnish-resistant deposits at high rates of speed from crystal clear solution. For industrial or decorative uses.

NICKEL PLATING PROCESSES

NICKEL GLEAM N-222 — ductile deposits, with exceptional leveling characteristics, high throwing and covering power. Same solution operates with air or mechanical agitation.

UNIGLEAM A & UNIGLEAM S — radically different single brightener type bright nickel process for still, mechanical, or air agitation operations; simple to operate; produces brilliant ductile highly leveled deposits (A—air agitated; S—still tank).

NICKEL-GLO BBN — a hot, bright nickel barrel process, producing brilliant deposits at high speed.

NICKEL GLEAM N-1 — bright all-purpose type of bath, exceptional tolerance to impurities, very active nickel surface. A true work-horse nickel bath.

NIKAL PC — a low stress high speed nickel solution designed for printed circuitry and other electronic uses.

CYANIDE PLATING PROCESS

COPPER-GLO — Bright copper — a proved brilliant high speed bath exceptionally tolerant to impurities.

CUPRALL — produces high speed buffable copper where brilliance is not required.

Q-LEVEL — a high speed lustrous copper process, produces excellent "hiding" characteristics. An ideal undercoat for bright nickel. Simple to operate and control. Uses one brightener.

AIR Q-LEVEL — Q-Level process designed for operation with periodic reverse current.

Q-STRIKE — a cyanide copper strike that produces a superior foundation for subsequent copper and nickel deposits.

CYANIDE COPPER ADDITION AGENTS: — usable with any type cyanide copper.

CW-7 WETTING AGENT — a wetting agent with high degree of stability. Increases tolerance of bath to organic contamination; benefits anode corrosion.

SUPERTARTRAL — exceptionally effective addition agent for cyanide copper baths; aids anode corrosion; reduces cyanide breakdown.

LR-1 — chrome reducer. Particularly effective in copper strikes and plating baths where chromium contamination is high.

TST — a purifier for all copper baths and strikes contaminated with zinc and chromium.

ACID COPPER PROCESSES

CUPROTYPE — smooth, tree-free heavy deposits at high speed. Proved for electronic use, (printed circuitry etc.) electrotyping, electroforming, etc.

COPPER GLEAM — brilliant deposits with exceptional leveling characteristics.

BRASS PLATING PROCESSES

BRASS-GLO — high speed brass process for still tanks well proved after several years operations in numerous plants. Uniform lustrous deposits over wide range of current densities with high cathode efficiencies.

BRASS-GLEAM— high speed brass process for barrels. Uniform brass colored deposits; wide range of current densities at high cathode efficiencies.

BRASS FLASH — additive for standard low temperature brass solutions where thin flash deposits are plated, for example, over bright nickel. Uniform stable color over wider current density range than with conventional brass baths.

ZINC PLATING PROCESS

BRIGHT ZINC — for barrel and still tank operation. Stable brighteners with long staying power.

CADMIUM PLATING PROCESS

BRIGHT CADMIUM — a bright protective cadmium electrodeposit for use on both ferrous and non-ferrous metals.

RINSES, ANTI-TARNISH, DRYERS, INSTRUMENTS, ANALYSES, ETC.

WATERSHED — liquid rinse aid which promotes free rinsing and fast drying; reduces staining and spotting of plated pieces.

CHROMESHED — a powdered water soluble material which reduces and ties up hexavalent chromium in rinse tanks and cleaners.

DRYER WDL-1 — a water displacing liquid which offers a simple economical means of drying plated work.

NOTARN "EC" — an anti tarnish treatment for solid and electroplated copper, brass, and grossly increases tarnish resistance, reduces spotting out.

LEA and LEA-RONAL for
BURRING, PLATING, BUFFING,
POLISHING, STRIPPING,
LAPPING, ANALYZING

industry's shopping center for Plating and Surface Finishing Products and Technical Service

Our laboratories in Jamaica, New York; Waterbury, Connecticut; and Detroit, Michigan, and our field engineers are always ON CALL. Lea is FINISHING HEADQUARTERS for literally hundreds of manufacturers... we would like to tackle your Plating or Finishing Problems. Write or call... we're ready to help you cut your costs and get a better finish.

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PERSONALS

GENE KANKOWSKI has been named sales manager of Platronics, Division of Palumbo Bros., Inc. Formerly a production executive in the electronics industry for several years, Mr. Kankowski originally joined the division as a sales engineer in April of 1960.

Prior to joining Platronics, Mr. Kankowski was associated in manufacturing or production executive capacities with L. L. Constantine, U. S. branch of McCulloch Co. of Canada, Ltd., and with C-O-Two Fire Equipment Co. Mr. Kankowski, who attended Newark College of Engineering, also holds a B. S. Degree in Accounting from Seton Hall University.

G. Kankowski

D. J. Miller

DAVID J. MILLER has been appointed by Deering Milliken, Inc. as technical field representative for buff cloth. He is a member-at-large of the American Electroplaters' Society and its Research Project No. 18.

♦

ALLEN G. GRAY has been appointed editor of periodical publications for American Society for Metals. While retaining editorship of *Metal Progress*, he will now have general editorial supervision of all society periodicals, including Metals Review, Review of Metal Literature, Metals Engineering Quarterly and Transactions Quarterly.

He is active as a member of the Advisory Committee to the U. S. Atomic Energy Commission on Industrial Information, and holds a number of patents relating to metallurgical treatment of uranium for atomic energy applications. As editor of *Metal Progress* since 1958 he has retained his great interest in the tremendous materials problems faced in development of missiles, rockets and space vehicles.

After receiving his Bachelor and Master's degrees in metallurgy from Vanderbilt University, Nashville, he earned his PhD at the University of Wisconsin, where he served on the teaching staff before joining duPont. He had served *Steel* magazine on part-time basis as consulting editor, 1942–1952, and joined the magazine's staff as technical editor from 1952–1957.

He is editor-in-chief of the Electrochemical Society monograph "Modern Electroplating," and has been lecturer for an advanced course at Western Reserve University, Cleveland, dealing with metallurgy, electroplating and corrosion.

♦

DR. ELWOOD F. BOOTH JR. has been appointed director of research for Solvay Process Division, Allied Chemical Corp.

Dr. Booth succeeds **DR. HERBERT C. WOHLERS,** who has been transferred to Allied Chemical's National Aniline Division as director of research and development.

An alumnus of St. Lawrence and Syracuse Universities, Dr. Booth joined Solvay Process in 1951. While earning his doctorate at Syracuse University, Dr. Booth served as an instructor in chemical engineering.

He has been assistant chief engineer and assistant manager of Solvay's Syracuse, N. Y., plant, and earlier this year was named an assistant director of research.

In his new position Dr. Booth will continue to be located at Syracuse, N. Y.

♦

LOUIS M. HAGUE was elected chairman of the board and chief executive officer of Hanson-Van Winkle-Munning Co. at a Directors Meeting following the Annual Stockholders' Meeting on April 17. At the same time **WARREN S. WILKINSON** was elected president. Mr. Wilkinson had been executive vice president since 1958.

L. M. Hague

W. S. Wilkinson

Mr. Hague joined H-VW-M in 1928 and was elected to the presidency in 1948. He had formerly been a vice president of the company. He is a member of the board of directors of Alert Supply Co., Los Angeles, the New Jersey Manufacturers Casualty Insurance Co., and the New Jersey Manufacturers Indemnity Insurance Co., both of Trenton.

Mr. Wilkinson joined H-VW-M in 1946 as plant engineer. In 1949, he became assistant purchasing agent and in 1956 he was appointed assistant to the president.

Mr. Wilkinson is a member of the board of directors of the Evening News Association, publishers of the Detroit News.

♦

RICHARD W. CRANE and **JOHN R. BARONE** have been appointed sales engineers for Industrial Filter & Pump Mfg. Co., Cicero, Ill.

R. W. Crane

J. R. Barone

Mr. Crane has been associated with Industrial Filter since 1953 in various positions, principally those involving research and development. He has worked on the company's filtration design projects as well as on water and waste treatment problems. He is a graduate of Western Illinois University, with a BS in chemistry and has worked on his MS at Notre Dame.

Mr. Barone joined Industrial in 1959 and has worked in the sales department exclusively. He attended Mount St. Francis and St. Anthony's Colleges in Indiana.

♦

MAHLON E. WOOD has been appointed Market Development Engineer for American Zinc Institute. His functions will include technical and educational activities related to the expansion of existing markets and the development of new uses for zinc in all forms.

For the past four years, Mr. Wood was assistant automotive market manager for Reynolds Metals Co., where he was responsible for national sales of Reynolds products to manufacturers of passenger cars, trucks, and buses.

Previously, Mr. Wood served with Ford Motor Co. as manufacturing research engineer. Prior to his service with Ford, he spent three years on the central engineering staff of General Motors Corp.

◀ INDICATE A 664.

SEVEN FEWER FINISHING STEPS...

2 OPERATIONS SAVED.
On base of small waffle iron, 1 cut-down operation, and 1 hand coloring operation have been eliminated through the use of Superlume.

1 OPERATION SAVED.
On base of large waffle iron, 1 coloring operation is no longer necessary.

3 OPERATIONS SAVED.
On round toaster shell, 1 cut-down operation and 2 coloring operations have been eliminated.

1 OPERATION SAVED.
On the steam iron shoe, 1 hand coloring operation has been eliminated.

yet SUPERLUME vastly improves all 5 of these Son Chief products ...and at no extra cost.

says NICHOLAS J. LAZZARO, JR.
Asst. Plant Superintendent
in Charge of Finishing,
Son Chief Electrics, Inc.,
Winstead, Connecticut

HIGHER QUALITY FINISH.
On square toaster shell, same finishing operations are required with Superlume, but appearance of product is tremendously improved. On all 5 products, in fact, Superlume has stepped up product quality appreciably—and, in every instance, *at no increase in cost.*

Son Chief Electrics, Inc., appliance makers, sought a thicker, brighter plate, more rapidly applied. They found it in Superlume—along with major reductions in finishing operations, plus what Nick Lazzaro calls "Tremendous improvement in our products' appearance . . . a real breakthrough in quality."

Actually, Son Chief is plating *twice* as thick in the same time as before (using 60 amps per sq. ft. instead of 30).

They're plating flat pieces now and forming *after* plating . . . a big production advantage unique with highly ductile Superlume.

Superlume bath is easier to maintain. Son Chief's normal operating schedule is 5 days, 16 hours a day. But for two months every year, they work on a *24-hour/5-day basis.* Average pieces per hour through trouble-free Superlume: 336, with a low of 226, a high of 904. Son Chief plates 30 different parts ranging from 1 to 20 inches long. Superlume bath in use: 3100 gallons.

Good-sized operation . . . healthy benefits . . . no added production costs. For full facts on Superlume as applied to *your* operation, contact H-VW-M. Chances are you, too, will be better off with this better bright nickel bath.

H-VW-M
Progress in metalfinishing through advanced processes • equipment

Hanson-Van Winkle-Munning Company, Matawan, New Jersey
Offices in Principal Cities
Alert Supply Company is H-VW-M in the West • Los Angeles • San Francisco

PHILIP H. MC LAUGHLIN has been named director of marketing, Vitro Chemical Company. He will have full responsibility for all marketing activities, including sales, market research, market development and related programs.

Mr. McLaughlin had been general sales manager of Century Chemical Corp., and was previously manager of the sales development and technical service departments, Stauffer Chemical Co. He has also held sales management positions with Davison Chemical Co., Sanitary Products Corp. and Revlon Products Co. He is a member of the American Chemical Society, Chemists' Club, Sales Association of the American Chemical Industry, Sales Executive Club, Ceramic Institute and Allied Forces Chemical Association, and is a trustee of the Porcelain Enamel Institute.

♦

H. W. MEDALIE formerly West Coast sales representative for Bogue Electric has joined Rapid Electric Co. as district sales manager of industrial power equipment. He will act as technical advisor for both the L. H. Butcher Co. (Div. of Wilber-Ellis) and Peninsula Associates.

A graduate of Fordham University, New York, (BSEE) and the University of West Virginia, Mr. Medalie brings 13 years of specialized training in sales of dc power supplies to militarized aircraft and missile development programs.

A member of both the IRE and ISA, "Hak" Medalie resides in Beverly Hills, California and is active in many civic affairs.

Mr. Medalie will service the entire West Coast. Both Butcher and Peninsula have offices located in the principle cities of Los Angeles, San Francisco and Redwood City, California; Portland, Oregon and Seattle, Washington.

H. W. Medalie

E. J. Conway

EARL J. CONWAY has been appointed a coatings specialist for Metal & Thermit Corp. Mr. Conway has been assigned special responsibilities for the marketing of the company's organic coatings line in the Detroit area.

He received a BS degree in chemistry and geology at the University of Chicago in 1932, and has spent his entire business career in sales and technical positions in the organic coatings and metal finishing industry.

Recently the head of his own coatings operation, E.J.C. Associates, he has also served as Detroit sales manager for the Electro-Chemical Engraving Company. Prior to that he held various sales and technical posts with the Rinshed-Mason Co., Jones-Dabney Co., Sherwin-Williams Co., and E. I. du Pont de Nemours & Co., Inc.

♦

JOHN W. MANQUEN has received appointment as technical director for the Metal Finishing Division of Frederic B. Stevens, Inc. Mr. Manquen will head the recently expanded Stevens Customer Service Laboratory and Product Development facilities located in the Stevens headquarters building at 1800—18th Street, Detroit.

Mr. Manquen was formerly employed by the Udylite Corp. for 15 years as a research chemist. He holds a BChE degree from the University of Detroit, class of 1944. He was a member of the United States Army and served in the European Theatre of Operations.

He is a member of the Detroit Branch of the American Electroplaters' Society and the Detroit Astronomical Society.

MANHATTAN RUBBER LINING
PROTECTS COSTLY PICKLING AND PLATING EQUIPMENT
...Permanently

STOP CORROSION
STOP CONTAMINATION

Photo courtesy Hanson-Van Winkle-Munning Co.

- THICK, MULTIPLE CALENDERED SHEETS
- INSEPARABLE RUBBER-TO-METAL BONDS
- ELIMINATE DANGEROUS "STRAY CURRENTS"
- NATURAL OR SYNTHETIC RUBBER
- WON'T HARDEN, CRACK OR OXIDIZE
- TESTED UNDER HIGH VOLTAGE

Be *certain* of lifetime protection for your costly equipment and protection against contamination of expensive plating baths. Specify Manhattan lining on your next tank lining job.

MANY MANHATTAN LINED TANKS HAVE BEEN IN CONTINUOUS USE OVER 30 YEARS!

ENGINEERED RUBBER PRODUCTS .. MORE USE PER DOLLAR

RM

Rubber Lining Plants at Passaic, N. J. • North Charleston, S. C. • Neenah, Wis.

RAYBESTOS-MANHATTAN, INC.

MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY

RM1039-R

JOHN H. HOKE has been appointed as assistant professor in the department of metallurgy of The Pennsylvania State University.

Dr. Hoke received the BS and MS degrees in metallurgy from Penn State, and the DEng degree in metallurgy from Johns Hopkins University. While he was earning his doctorate, he served as instructor of metallurgy at Johns Hopkins. He had held industrial research positions with the Armco Steel Corporation as research assistant, with the Babcock and Wilcox Company as research metallurgist, and with the Crucible Steel Company of America as research supervisor, stainless steels.

Dr. Hoke is a member of the American Society for Metals, the Metallurgical Society of the AIME, the National Association of Corrosion Engineers, Tau Beta Pi, Phi Lambda Upsilon and Sigma Gamma Epsilon.

♦

The appointment of **J. GEORGE WARNECK** as sales engineer assigned to their Los Angeles Office has been announced by Sel-Rex Corporation, Nutley, New Jersey, manufacturers of precious metal electroplating processes. Mr. Warneck, who was president and general sales manager of his own company, Warneck Industries, will handle sales and service of semiconductor rectifier equipment and automatic metal processing machinery, manufactured by The Meaker Company, Chicago, a wholly-owned subsidiary of Sel-Rex Corporation.

Mr. Warneck attended Los Angeles City College. Among the technical and executive positions held during his 20 year career in industry were: mechanical engineer with Lockheed Aircraft Company of Burbank, and consulting engineer to prime and subcontractors in various missile and rocket projects.

Mr. Warneck will operate principally in the Los Angeles and San Diego areas.

♦

WILLIAM A. HOPKINS has been appointed as electroplating product specialist for Metal & Thermit Corporation. Headquartered in M&T's Detroit offices, he has been assigned special responsibilities for anodes and chemicals for nickel-chromium plating.

Mr. Hopkins previously was general manager of the Sharonville Division Plant of Electric Auto-Lite Company near Cincinnati. From 1952 through 1957, he was vice president in charge of sales for Bart Manufacturing Company, Belleville, N. J. Prior to this, he was Michigan district sales manager for McGean Chemical Company. In all, Mr. Hopkins has been associated directly and indirectly with the electroplating industry for more than 25 years. He is a member of the American Electroplaters' Society.

DR. JOHN F. G. HICKS has been named associate director of Battelle Memorial Institute.

Formerly vice president of the Corning Glass Works and vice president and technical director of Corning Glass International, Dr. Hicks is a chemist with broad experience in industrial research and development and in corporate management. A former National Research Fellow and Research Associate at Massachusetts Institute of Technology, he first became associated with Corning in 1938 as a research chemist. In 1943, he was granted leave of absence to work on the Manhattan Project at Columbia University and Oak Ridge, Tennessee.

A native of Philadelphia, Dr. Hicks was graduated from the University of Washington with a BS degree in 1929 and an MS degree in chemistry in 1931. He was awarded a doctorate in physical chemistry by the University of California in 1933. He held teaching fellowships at both universities and, as a National Research Fellow, was engaged in chemical research at Massachusetts Institute of Technology prior to his association with Corning.

♦

MALCOLM R. STARK has been named office manager of The Diversey Corporation's Southern Division headquarters in Atlanta, Ga. Since 1958 Mr. Stark had been a divisional sales correspondent with Diversey's Cleveland Division.

UP TO 48% GREATER EFFICIENCY!

IMPERIAL PLATING BARRELS

WITH NEW "FIN" DESIGN

An important "first" from Imperial! In actual tests against standard plastisol-coated steel plating barrels, an Imperial all-plastic barrel with the exclusive "fin" design *increased plating thickness 48%*. The secret is reduced electrical resistance and more thorough agitation and uniform circulation in the plating solution.

Imperial manufactures higher-efficiency plating barrels in a wide range of sizes, materials, and models. They are 100% interchangeable with the standard barrels on your automatic plating machines. Barrels illustrated are made of polypropylene (*first* used for barrels by Imperial several years ago) or COPOLEFIN—a special olefin copolymer. Features: Sturdy, all-welded and reinforced construction; great resistance to chemicals, stress, impact, abrasion, heat; long service life; light weight; and low cost. They stand up under all solutions and temperatures. The units are also available in high-temperature Plexiglas and other materials, on special order.

Imperial makes horizontal belt and gear driven barrels to fit your existing plating equipment, as well as plastic tanks, ducts, hoods, and other custom-fabricated parts.

All barrels are backed by years of manufacturing experience — plus a warranty. Write now for free literature.

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DAWES WALTER has received appointment as manager of advertising and public relations and **RICHARD S. LEE** as assistant advertising manager of Pennsalt Chemicals Corporation. The department will be responsible for the direction and coordination of all phases of the firm's advertising and public relations, giving major support to increased emphasis on marketing.

Prior to joining Pennsalt, Mr. Walter was with the Atlantic Refining Company where he has held various marketing and advertising management posts since 1952. Prior to recall to the Marine Corps in 1951, he was a wholesale and industrial salesman for the Franklin Division of the American Sugar Refining Company. He is a native of Chicago, Illinois, and was graduated from Princeton University in 1948.

Mr. Lee moves to his new assignment from the post of sales promotion manager, Industrial Chemicals Division. Prior to joining Pennsalt in 1956, he was in the research department of the Burroughs Corporation. He is a native of Erie, Pennsylvania, and was graduated from Penn State University.

♦

Dr. NATHANIEL L. REMES has been appointed senior research chemist in the organic research and development group, Metal & Thermit Corporation at Rahway, N. J.

Dr. Remes received his PhD as well as his Master's degree from the University of Connecticut at Storrs, Conn. His undergraduate degree is from Amherst College.

Before joining Metal & Thermit, he was a research chemist at Allied Chemical Corp.'s Morristown laboratory. Earlier, he held research and teaching posts at Pure Oil Company, the University of Miami, Northwestern University and the University of Connecticut.

Dr. Remes' professional activities include the American Chemical Society, the American Association for the Advancement of Science, Phi Lambda Upsilon and Sigma Xi.

♦

DR. ELWOOD F. BOOTH JR. has become assistant director of research; **DR. EDWARD R. DEGGINGER,** research supervisor; and **DR. MICHAEL J. SKRYPA,** associate research supervisor of the Solvay Process Division, Allied Chemical Corporation.

A graduate of St. Lawrence University, Dr. Booth received his Doctorate in chemical engineering from Syracuse University. Joining Solvay in 1951, he has been assistant chief engineer and assistant manager of the Syracuse, N. Y. plant.

Dr. Degginger has been with Solvay's research department since 1952. He received his Doctorate in organic chemistry at the University of Wisconsin.

Dr. Skrypa held a teaching fellowship at Clark University, Worcester, Mass., while working for his Doctorate in organic chemistry. He is a graduate of Brown University. Associated with Solvay Process since 1953, he has been a senior research chemist.

♦

HAROLD E. IMES has received appointment as president of its Semet-Solvay Division, Allied Chemical Corp.

Starting as assistant chemist at its Ironton, Ohio plant laboratory in 1922, Mr. Imes has spent his whole business career with the Semet-Solvay Division rising through various operating assignments to superintendent of the Ashland, Ky. plant in 1933.

In 1943 he became division superintendent for the Ashland and Ironton plants and River Transportation. In 1951 he moved to the general offices in New York as assistant general superintendent, and was named director of operations in 1956.

Mr. Imes was appointed vice president of Semet-Solvay Division in 1958. He succeeds **ALBERT E. SCHERM** who is retiring after twenty years of service as president of the Division.

♦

A. JAMES JOHNSTON JR. has been named as assistant to the manager of the Organic Chemicals Section, Solvay Process Division, Allied Chemical Corp.

A graduate of Temple University, Mr. Johnston joined Solvay in 1953 as a salesman at the St. Louis Branch, and in 1957 was assigned to the Charlotte, N. C. territory.

♦

BAIRD BARREL ANNOUNCES APPOINTMENT OF FOUR DISTRIBUTORS

The appointment of four new distributors has been announced by Barrel Finishing Equipment Division, The Baird Machine Co., Stratford, Conn.

The Aldachris Ultrasonic Distributing Co., Cleveland, Ohio, will cover the area of Northern Ohio and Western Pennsylvania.

Davies Supply & Manufacturing Co. with sales offices and warehouses in St. Louis, Mo., Kansas City, Mo. and Dallas, Texas will handle the southwestern territory.

The Southern Ohio, Southern Indiana, West Virginia, Virginia, Eastern Tennessee and Kentucky area will be handled by Bill Young Co. of Cincinnati.

The Donald Sales and Manufacturing Co., Milwaukee, Wisc., will cover the state of Wisconsin.

"pH PAPERS"

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Indicator AND control-colors on SAME strip. Control-colors in steps of 0.2 pH and 0.3 pH.

Plating ranges
(200 strips of a range per box)

Acid:	Alkaline:
6.0–7.4 pH	6.6– 8.0 pH
*4.8–6.2 pH	7.3– 8.7 pH
*3.6–5.0 pH	8.6–10.0 pH
*2.4–3.9 pH	10.1–11.3 pH
1.0–2.8 pH	10.5–13.0 pH
0.4–1.4 pH	11.0–13.1 pH

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BRANCH NEWS

Total AES Branches U. S., Canada, Australia, June 1, 1961—60.

BLUE RIDGE

Stevens Speaks on Finishing of Magnesium

The Blue Ridge Branch held its regular monthly meeting April 7, 1961 at the Tropicana Steakhouse in Greensboro, North Carolina. Twenty-six members and guests attended. **Bruce Wallace,** Branch president, presided.

The nominating committee selected as a slate of officers for 1961–1962: **Mike Milo,** Western Electric Company, president; **Carl Witherspoon,** Poly Scientific, first vice president; **Roy Lewis,** Metal Finishing Company, second vice president; **Donald McGee,** Bassick-Sack, secretary-treasurer. Those nominated for the board of managers are **Bruce Wallace, Dr. Nelson Murphy** and **Walter Conine.** Elections will be held at the May meeting.

Three new members were elected.

After the business session, **Dr. John A. Stevens,** Dow Chemical Co., talked on the "Finishing of Magnesium."

Donald H. McGee
Secretary

BUFFALO

Question and Answer Meeting; Donaldson Heads New Slate

The Buffalo Branch held its monthly meeting Friday, April 7, at the Niagara Manor Restaurant, Buffalo, N. Y. There were 24 members in attendance.

The secretary read a letter from **Frank Beuckman,** National Third Vice President, advising he will be present at the installation of new Buffalo Branch officers to be held May 12.

President **Harold Shapiro** advised he has tickets available for the forthcoming Industrial Science Fair to be held in Buffalo and advised all to attend.

John Donaldson, chairman of the Membership Committee, stated the Buffalo Branch has succeeded in attaining its 10 per cent increase in membership goal.

Rolland Campbell reported on the recent Regional Board meeting relative to the proposed bylaws governing Regional Annual Meetings. Mr. Campbell advised most of the other Empire State Regional Branches were also opposed to the proposed bylaws. In particular question was the $500 fund to be setup as insurance against Act of God catastrophes that result in Host Branches becoming financially embarrassed.

Ray Blechinger suggested the Buffalo Branch should not subsidize another Branch's losses. **Bert Kirchoff** advised if a Branch cannot risk a Regional Meeting on its own they should not bid for same.

A motion was made, seconded and carried by a close vote that Buffalo will not support the proposed fund.

A committee consisting of **Richard Davis, George Wolf** and **Ray Blechinger** was appointed to find a new meeting place for the 1961–1962 season. It was felt that this move may stimulate new interest for those members not attending meetings.

Chuck Fotheringham, chairman of the nominating committee presented the following slate of new officers for the 1961–1962 season:

President, John Donaldson; first vice president, Richard Davis; second vice president, **John Tiebor;** third vice president, **Mat Hayes;** secretary, **Robert Eich;** librarian, George Wolf; treasurer, **Melvin Stachura.** Board of Managers, Harold Shapiro, Rolland Campbell, **John Scholterer.**

Following the nominations, the candidates were duly elected to office.

Daniel Stachowiak was appointed chairman of the new finance committee to create interest in the Buffalo Industrial area to obtain additional sustaining memberships.

Librarian **John Tiebor** opened the technical session with questions from the question box and from the floor. Those in attendance who presented Metal Finishing problems were well satisfied with the discussions and answers received.

CAPITOL DISTRICT

Visit To Arsenal Top Meeting of Capitol District Branch

by Robert Wolfe, Branch Librarian

An event that was outstanding in the history of Capitol District Branch took place last Monday evening, April 3, 1961. With the excellent cooperation of the officials and personnel of the U. S. Army Arsenal at Watervliet, N. Y., a dinner meeting was held in the restaurant of the Arsenal, followed by a guided tour of the metal finishing departments on the post.

We were happy indeed to have more than 40 members and friends of the Mohawk Valley Branch, of Utica, N. Y. and surrounding area, join with us on this occasion. The total attendance count showed that some 96 men who are active in or associated with plating in upper New York State and New England, made the trip to Watervliet for this evening from points as far away as Syracuse, Johnson City, North Adams, Mass. and elsewhere, with a few coming from Connecticut.

During the social hour preceding the dinner, the Officers' Club did an excellent job of keeping the jovial visitors in the best of "spirits". It was heartwarming to see so many long standing friendships and associations among platers of the State enthusiastically renewed.

Our official host for the evening was none other than our good friend and hard working Branch Past President, **Bob Hill.** Bob, who is supervisor of Industrial Finishes Section, Research and Engineering Division at the Arsenal, was ably assisted by his staff members, **Ted Pochily** and **Pete Greco.** These men did an outstanding job of conducting the tour, explaining the operations and answering questions.

Following the fine turkey dinner served at the Arsenal cafeteria department, we were shown the new installation recently put into operation for hard coat anodizing of aluminum. The assemblage was then divided into two groups and alternately shown (1) the facility for hard chromium plating large calibre gun tubes, and (2) the newer operation for heavy deposition of nickel on gun tubes for salvage purposes.

The general reaction from those attending was not only favorable, but was emphatic in declaring this one of the most enlightening and interesting meetings and plant visitations ever held during our few years of activity. All expressed gratitude for this opportunity afforded us by the Watervliet Arsenal Command and its personnel.

CHICAGO

No Shop Talk on Ladies Nite

On Saturday evening, April 8, 1961, the annual "Ladies-Nite" of the Chicago Branch was held. The place selected was the Lilac Lodge at 22nd and Wolf Road in Hinsdale, Illinois. The lodge is a very attractive place with congenial atmosphere. The gals were treated to cocktails and the members had a choice of a chicken or ham dinner. After the excellent dinner, **Joe Andrus,** chairman of Ladies Nite,

BRANCH SECRETARIES

Branch News is required of all Secretaries monthly by AES Bylaws. First of the month is Branch News deadline for next PLATING issue. Any items on hand on that date will be carried in that edition. Later arrivals will appear in the issue immediately following. In reporting talks given by speakers before the Branch, please give titles of the talks, the speakers' full identification and any other pertinent information of interest to other Branches and PLATING's broad readership.

introduced the officers and members of the board of managers for the coming year. The officers are president, **Rudy Hazucha**; first vice president, **Joseph C. Corre**; second vice president, **Art Bartman**; secretary-treasurer, **Paul Glab**; librarian, **Charles Geldzhaler.** The board of managers are **Matt Dassinger**, chairman; **Robert Waits, Charles Jensen, Willard Carter** and **Christopher Marzano.**

Rudy Hazucha was then called to say a few words of welcome to the ladies. This was their Nite and they were assured of no shop talk of any kind. The writer, who was co-chairman of "Ladies Nite," was called an "Honest Joe" by Joe Andrus to conduct the raffle for the door prizes. **Mrs. Irene Modjeska** picked the following names for the door prizes: the $5 gift certificate winners were **Mrs. Ruth Kraft, Mrs. Betty Gary** and **Mrs. Francine Davy**; the $10 gift certificate winner was **Mrs. Florence Marzano** (how about that???) and **Mrs. Blanche Martinek** won the $15 gift certificate.

The program for the evening was a talk "Russian Side-Lights" illustrated with colored slides given by **Samuel Becker.** The Russians decorate their subways as if they were parlors in a luxurious home. The walls of the stations are decked with the finest paintings, mosaics, lighting fixtures, exquisite chandeliers and brilliant color schemes. It seems as if each station tries to outdo the other in ornamental finery. The Russians do not care to talk when asked pointed questions of any kind, the word "mum" really goes. In one of the slides of Moscow, a liberty bell is found in one of the public squares, it is their "liberty-bell" and you would hardly believe it, there is a crack in the bell—shades of Philadelphia. The slides depicted the cultural and agricultural life of Russia and was a very interesting talk and Mr. Becker answered many questions. We do hope that the ladies had a wonderful time at the affair.

Christopher Marzano
Publicity Chairman

DAYTON

Vacuum Metalizing Discussed by West

During the regular April meeting of the Dayton Branch at the Biltmore Hotel on April 19, President **Byron Bowman** announced that a Monte Carlo Party will be held on June 3 at the Delco-Moraine Recreation Center.

The speaker of the evening, **James West**, field engineer for the F. S. Stokes Corp. of Philadelphia, was introduced by Branch Librarian **Walter Anderson.** Mr. West discussed "Vacuum Metalizing" in a very informative manner and illustrated his presentation with numerous colored slides.

The next Dayton Branch meeting will be a dinner meeting at Kuntz Cafe on May 17. Election of officers for the next fiscal year will precede a talk on Organic Finishes by **Dr. Fenburr** of Hanna Paint Co., Columbus, Ohio.

L. A. Critchfield
Public Relations Chairman

DENVER

Tour Heiland Plant; Picnic Planned

The Denver Branch met April 14 at the Rathskeller and the dinner and meeting were attended by 60 members and guests. Following the dinner a short business meeting was held and the list of candidates selected by the nominating committee was presented to the meeting. The election and installation of officers will take place during the May meeting. A report will be given by the chairman of the program committee at the May meeting on the status of the picnic. Six new members were presented to the meeting.

Following the meeting the group reassembled at the plant of the Heiland Division, Minneapolis-Honeywell Co. The members were conducted on a tour of manufacturing facilities, engineering and metal finishing. The metal finishing facilities included copper, nickel, chromium, silver and rhodium plating; anodizing; bright dipping; barrel tumbling and painting. The group appreciated the efforts of **Pete Lucatuorto** of Heiland in arranging the plant tour.

Elmer Schuster
Secretary

DETROIT

Finishing Discussed by Strom

The regular monthly meeting of Detroit Branch was held on May 5 at the Statler Hilton Hotel in Detroit.

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Again...
and
Again...
and
Again!
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The educational program was in charge of Technical Chairman **Richard A. Fellows.** He introduced **John Strom,** the technical director of the Ransohoff Company, who spoke on "Vibratory Finishing." Mr. Strom, a member of the AES, made a very thorough presentation of his subject and replied with interesting details to many questions.

William G. Anderson
Publicity Chairman

HARTFORD
Hartl Talks on Barrel Plating

The regular Branch meeting was held at the Bond Hotel on March 20, and 36 members and guests were present. Preceding the meeting a short movie was shown followed by a short explanation by **Stanley Platoz** on how several plating problems were solved at his plant. Then a brief "trouble shooting" clinic was held.

The guest speaker for the evening was

On the green at the Detroit Stag Day last summer

DETROIT STAG DAY SET FOR JULY 22

The Detroit Branch of AES has announced plans for its annual Stag Day to take place at Glen Oaks Country Club in Farmington, Michigan on July 22.

Highlights of the event will be a breakfast, golf all day, a steak dinner, floor show, free beer, and the awarding of over $700 worth of door prizes.

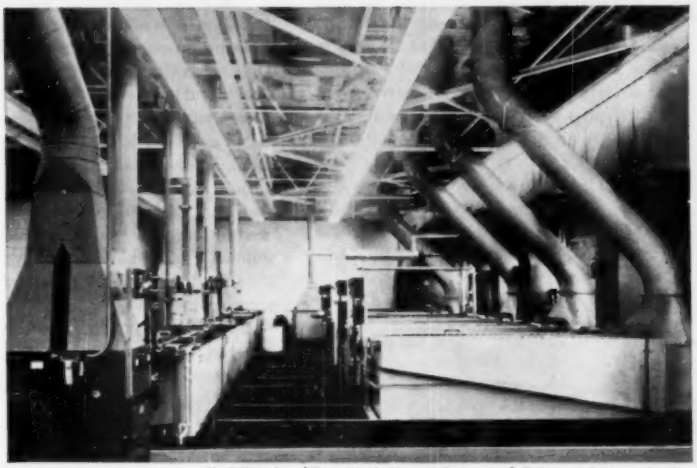
It is expected that the number of participants in the 1961 Stag Day will exceed the 750 members and guests in attendance last year.

Stag Day Committee members for 1961 are: General Chairman, **Louis J. Camill;** Entertainment Chairman, **William Lovell;** Food and Drink Chairman, **Roger E. Marce;** Door Prize Chairman, **John F. Siefen;** Ticket and Finance Chairman, **Robert H. Dudley;** Athletic Chairman, **William Lumsden;** and Publicity Chairman, **William G. Anderson.**

William G. Anderson
Publicity Chairman

HEIL of Cleveland

PLASTIC VENTILATING SYSTEM at *Western Electric* plant



Heil Rigidon (Glass Reinforced Polyester) Exhaust System in the Plating Room of Western Electric Company's New Omaha Plant.

features attractive appearance, high strength, long life, easy installation and complete corrosion resistance

Western Electric Engineers wrote the specifications. The ventilating system for their plating room must look as modern and attractive as all other parts of their new plant. The system must positively resist exposure to fumes and the splash of acids and alkalies. It must be sturdy and rigid; and combine long life, low maintenance, be easy to install or re-arrange, and low in first cost. The Heil Rigidon system pictured above met all these requirements.

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Josep Hartl of the Norton Company whose subject was "What's New in Precision Barrel Finishing."

Mr. Hartl stated that the chemical compounders helped the tumbling field by developing new compounds to keep the parts shiny and bright. The following must be considered in determining what procedure to use: 1) Size and shape of the part, 2) Kind of metal and its hardness, 3) Size of burr, and 4) Finish required.

Slides were shown illustrating the kind of parts that are tumbled and the various sizes of barrels. Caution must be used in doing samples in a small barrel and then transferring the job to a big barrel—you don't always get the same results. Besides barrels, chips and compounds, the following should be available: 1) Hot water, 2) *p*H papers, 3) Compressed air, 4) Graduated beaker, 5) Weighing scale and 6) Index file. Various sizes and shapes of natural and manufactured tumbling media were shown.

The technical chairman for the evening was **Edwin Crandall.**

Stanley Platoz
Secretary

HARTFORD

New Officers Installed; Plating Wastes Discussed by Weisberg

The regular Branch meeting was held at the Bond Hotel on April 17 with 36 members and guests present. Preceding the meeting **Arthur Logozzo** installed the following new slate of officers: President, **Stanley Grabowski;** first vice president, **Edwin Crandall;** second vice president, **Ruel Katz;** secretary, **Stanley Platoz;** treasurer, **Armand Roy;** educational advisor, **Ralph McCahan;** educational committee, **Vincent Sordillo,** chairman, **Michael Grabowski** and **Stanley Kowalczyk.** Board of managers, **Walter Dyber, Arnold Johnson** and **Ralph Chase.**

The guest speaker for the evening was **Dr. Louis Weisberg** whose subject was "Plating Wastes; Disposal or Recovery". Dr. Weisberg stated that each state has its own standards for waste disposal and that these standards are getting tighter.

No recovery is attempted on acid and alkaline rinse waters; they are mixed together and the *p*H brought to 6.5 to 8.5, and the sludge formed is removed. A counter-current recovery rinse system following zinc plating was described as also was the evaporator for recovering the zinc plating salts.

If cyanide solutions are not to be recovered, they can be rendered harmless by chlorination. The use of ion exchange for recovering chromates from the bright dip was described and yielded substantial savings.

The technical chairman for the evening was **Ruel Katz.**

Stanley Platoz
Secretary

INDIANAPOLIS

Hardesty Explains Corrosion Testing

The April 4 meeting of the Indianapolis Branch was attended by 36 members and guests at the Construction League. **John Holland,** president, opened the meeting with introductions, reports of secretary and treasurer and announcements. A by-laws committee was appointed to draw up a set of bylaws for our Branch and present them at the next meeting or soon after. This committee is composed of **Richard Watson,** chairman; **Les Reynolds** and **Quentin Shockley.**

The May meeting of the Branch will be changed from the regular first Tuesday to Thursday, May 4. Mr. Holland announced that election of officers will be held during the May meeting and the ticket would be announced at the meeting. Nominations from the floor also will be in order.

Discussion followed as to whether the Branch should have a June meeting which had not been customary. After many ideas were presented, they were taken into consideration and might be used for future June meetings.

John Hood reported additional information on the Interim Meeting at Hartford, Conn.

Dr. Bernard Agruss announced the Electrochemical Society meeting at the Claypool Hotel on May 1, 2, and 3.

Robert Stewart, librarian, introduced

	A	B	C	D	E	F	G
TO PLUG HOLE SIZE	1/8-3/16	3/16-1/4	1/4-5/16	5/16-1/2	1/2-5/8	9/16-11/16	5/8-3/4
TO CAP STUD SIZE	3/32-5/32	5/32-3/16	3/16-1/4	1/4-5/16	5/16-3/8	3/8-7/16	5/16-1/2

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Perma-Brites: Uniform, commercial finishes at lowest cost.

ROHCO 503: Most popular zinc brightener in plating.

ROHCO Zinc Purifier: Purges zinc plating baths — saves brightener.

ROHCO Zinc Sol: Add water for instant zinc plating bath.

ROHCO ZW-600: Wetting agent for more efficient, cleaner zinc plating.

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Rodips ZN-22, ZN-23, ZN-25, ZN-30, etc., for zinc: Superior post-plating treatments for passivating and coloring zinc plate.

Rodip AL-50 for aluminum: Superior chromate treatment imparts corrosion protection to aluminum and its alloys.

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the speaker of the evening, **David Hardesty**, General Motors Research Laboratory, who talked on "Accelerated Corrosion Tests". Mr. Hardesty showed many slides on equipment used in testing, also graphs of various tests, results, etc. He said that the many tests improved considerably last few years and that plating is now much better. A question and answer session followed the address.

Edna Rohrabaugh
Secretary

KANSAS CITY
Foreign Competition Discussed by Davis

The February 15 meeting of the Kansas City Branch of the American Electroplaters' Society was held at the Berkshire Hotel. The Oakite Company was host for a social period starting at 6:30. Dinner followed promptly at 7:00 p.m. Following dinner the meeting was called to order by President **Warren Eliot.**

Robert Garland reported that the Branch is incurring a monthly expense because members are not using their dinner reservations. After considerable discussion, it was decided that no penalty be assessed against members who do not attend the meeting after making reservations, but that they be informed of the extra expense this is causing the Branch.

Robert Garrett brought before the group the matter of changing the Branch's annual fiscal year to agree with the calendar year. After considerable discussion, Mr. Eliot appointed Mr. Garrett chairman of a committee of his own choice to study this problem.

R. E. Loupee moved that the Branch replace the regular May meeting with a dinner-dance at an approximate cost of $10 per couple. The motion carried.

Mr. Loupee introduced to the Branch **R. W. Davis,** superintendent, bolt and forged products department, Sheffield Division, Armco Steel Corporation, who spoke on the subject, "Your Foreign Competition as I Saw It." The first portion of Mr. Davis's talk was devoted to a general analysis of foreign competition and certain specific examples were cited to show its effects on American industry. The second portion of his talk was accompanied by a group of slides taken in the seven countries he had visited. The slides showed some of the industrial plants which had been visited and also served to show the general prosperity which Europeans are enjoying. Following the talk, questions were answered.

Robert W. Davis
Secretary

PLATING MAGAZINE invites AES Branches to furnish news for publication in PLATING concerning electroplating courses sponsored.

KANSAS CITY
Barrett Speaks on Nickel Sulfamate Plating

The regular meeting of the Kansas City Branch of the American Electroplaters' Society was held at the Berkshire Hotel on March 16. Dinner was served to the group at 7:00 p.m. following which **Warren Eliot** called the meeting to order.

R. L. Garrett reported that he had asked **Robert Nederman** to assist him in preparing a proposal regarding the change of the Branch fiscal year to coincide with the calendar year. Though a formal report has not been prepared, Garrett spoke briefly on the ideas being considered.

R. E. Loupee reported on plans for the Branch Dinner-Dance Social to be held on May 19.

W. E. DesJardins reported on the progress of the Membership Drive. Again he asked for the assistance of all in this work so vital to the strength of the Branch.

The speaker of the evening, **Richard Barrett,** of the Barrett Chemical Products Company, was introduced by Mr. Loupee. Mr. Barrett spoke to the group on the subject of the "Nickel Sulfamate Plating Process." Mr. Barrett observed that there had been a great deal of confusion about the origin, history, and use of sulfamate nickel. It was originally developed at the University of Milan in Italy but did not come into wide-spread use until the Barrett process of stress-free sulfamate nickel was developed in the United States. It is used in the graphic arts industry, for phonograph record stamping, and for plating highly stressed high strength aircraft parts. Throughout his talk Mr. Barrett accepted questions from the members and used them in discussing areas of interest for the group. These questions led to an explanation of the chemical composition of nickel sulfamate and to an explanation of its physical properties. Modifications of stress-free sulfamate plating solutions were explained which would give a hard compressive coating or which could be used in barrel plating.

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The meeting was adjourned by President Eliot at 10:30 p.m., but Mr. Barrett remained to answer specific questions which his talk had raised in the minds of members.

Robert W. Davis
Secretary

KANSAS CITY
DesJardins Heads New Slate of Officers

The regular April 13 meeting of the Kansas City Branch of the American Electroplaters' Society was held at the Berkshire Hotel. The meeting was called to order by President **Warren Eliot** following a recess after dinner. Each member present introduced himself and his guests.

Two new members were elected.

The secretary polled the Delegates and Alternates to the 1961 Annual Meeting and determined those who will be present at that meeting.

R. E. Loupee reported on the plans for the Branch Dinner-Dance to be held on the evening of May 19.

Warren Eliot asked Scott Sterrett, chairman of the nominating committee, to report the committee's proposed slate of officers for the coming year. He reported as follows: President, **W. E. DesJardins;** first vice president, **Robert Garrett;** second vice president, **R. E. Loupee;** secretary, **Robert W. Davis;** treasurer, **Robert Nederman;** librarian, **Robert Garland;** Board of Managers, **Olin Bock, C. Scott Sterrett, W. B. Eliot.**

Warren Eliot asked for nominations from the floor. There were none. Olin Bock moved that the proposed slate be elected by acclamation. The motion was seconded by **Glen Wilson** and acted upon favorably by the Branch.

The matter of a Branch Research Finance Chairman for the coming year was discussed. R. E. Loupee was appointed to this position by Warren Eliot.

The program for the evening consisted of a discussion moderated by R. E. Loupee by the entire membership of the goals each would like to see the Branch attain during the coming year and the programs which were thought to be of general interest to the members. A very stimulating and thought-provoking discussion was carried on.

Robert W. Davis
Secretary

LANCASTER
Geyer Talks About Conversion Coatings

The regular monthly meeting of the Lancaster Branch was held at the Lincoln Woods Inn in York, Pennsylvania on April 14. The minutes of the previous meeting and the financial statement were read and approved as read.

President **Paul Sharretts** called for nominations from the floor for Branch officers. There being none, **Joe Shockcor** moved that the secretary be instructed to cast a unanimous ballot for the officers nominated by the nominating committee. It was seconded and approved unanimously. The new officers are: President, **George Geesey;** vice president, **Martin Frant;** secretary-treasurer, **Joe Shockcor;** librarian, **John T. Schreck Jr.;** Board of Managers: Paul Sharretts, **Clester Smith, Robert Plaisted.**

The secretary reported that about 30 members had replied to the questionnaire and that favorable information had been received on suggestions for topics to be covered at meetings, meeting locations, Ladies Night and other subjects.

It was reported by several of the members that **Charles Snyder** would return from his around-the-world trip before the next meeting and it was suggested that the next meeting be "Welcome Home Charlie Snyder" Night. It was also suggested that if possible Charlie be asked to show some of his color slides. Paul Sharretts and Martin Frant volunteered to handle the arrangements for the meeting.

The speaker of the evening was **John H. Geyer** of Amchem Products, Inc. who gave an unusually interesting and thorough talk on "Chemical Conversion Coatings for Metal Surfaces." Mr. Geyer distributed samples of the various coatings to all of the members present and gave an informal talk on their applications, usefulness and drawbacks.

There were 26 members present and one guest, **Bradley Oldenberg** of AMP Incorporated.

Martin Frant
Secretary

LOS ANGELES
New Officers Elected; Squitero Speaks on Difficult to Plate Metals

In the absence of **Frank Virgil,** first vice president **Emmett Babcock** opened the March 8 meeting.

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Emmett Babcock announced that the regular June 14 meeting would be a joint meeting of the San Diego Branch and the Los Angeles Branch, with the meeting to be held at Roger Young Auditorium in Los Angeles.

The first vice president introduced an applicant for membership in the Society, and a new member was duly accepted into the Los Angeles Branch.

Norm McEwan, speaking for the Board of Managers, opened the meeting for nominations for Branch officers for 1961–1962. The following were elected: President, Emmett H. Babcock; first vice president, **Harvey K. Hunt**; second vice president, **Don E. Baudrand**; treasurer, **Robert H. Pooler**; secretary, **Harold Wanamaker**; educational chairman, **Eugene Bozel**; Board of Managers, Frank Virgil, **Norman Painter, Truman Stoner.**

A talk on "Plating on Difficult to Plate Basis Metals" was given by **A. D. Squitero** of International Nickel Co. Slides were used to present statistics and many questions proved the membership interest.

R. H. Pooler
Secretary

LOUISVILLE

Panel Discussion on Finishing Proves Informative

The Louisville Branch at its March meeting had a round table discussion on four facets of finishing. The panelists were **Stanley Beyer** on general plating problems, **Harlan Bowsher** on aluminum anodizing and **Herbert Kennedy** on cyanide solutions. The moderator was **Arthur Oertel.**

As is usually the case at these annual discussion periods, some thought provoking questions were put to the panel and answers were forthcoming from "audience" members as well as the panelists.

The meeting was held at Hasenours Restaurant and the above discussion followed a short business meeting. The nominating committee reported their results and announced that election of officers will be at the April meeting.

Arthur A. Oertel
Recording Secretary

MIAMI

Buff Cloths Presented by Miller

The April 21 meeting was held at the PARC Miami, Fla.

The meeting was chaired by **Earl Kennedy.** The following were presented as the slate of officers for the year 1961–62 and **Fred Fulforth,** chairman of the nominating committee, presided at the election. The new officers are: President, **Earl Kennedy**; first vice president, **M. H. Dent**; second vice president, **Jack Craig**; secretary-treasurer, **Charles Posner**; librarian, **Anthony Rotoli**; Board of Managers, Charles Posner, M. H. Dent, **Walter Donnelly, Rolla Taylor**; Delegates, M. H. Dent, Fred Fulforth, **Stephen Putzan**; Alternates, Charles Posner, Earl Kennedy, **Frank X. Marinello.**

Our dinner was made all the more pleasant when Mrs. Stephan Putzan, a surprise guest at the meeting, acted as hostess at dinner.

It was voted that **Leonard F. Marinello,** maintain his full membership status, without dues, for the duration of his service in the armed forces.

The Miami Branch was invited to join the South Florida Council of Technical Societies. This invitation was accepted and Jack Craig was appointed as the representative of the AES. Anthony Rotoli will represent the AES at the meetings of the local ASM.

The speaker of the evening was **David Miller,** technical field representative of the Deering Milliken buff cloth program. He traced the growth of the need for special buff cloths and the progress being made in that field from prior to 1920 to the present. The color film, "Cotton—Natures Wonder Fibre" was most enlightening. The talk indicated that more and more the finishing trades are going from the age of art to the age of science, and science will always seek to turn out a product of greater quality.

Abe Schorr
Secretary

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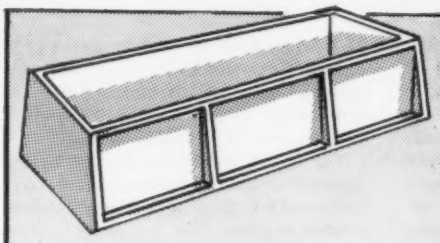

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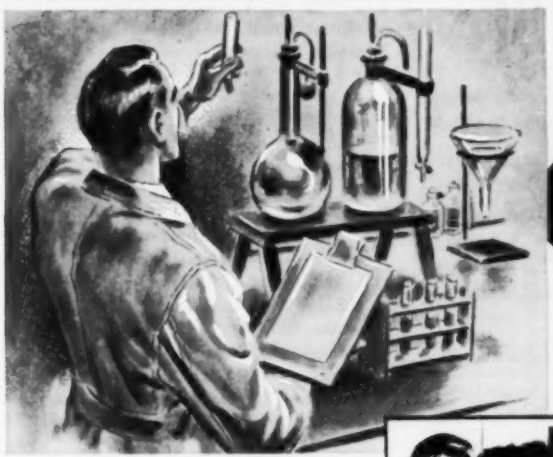

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MILWAUKEE
Gala Colors, Exotic Metals, and Flying Saucers

The program of the April 7 meeting provided members and guests with an unusually wide range of entertaining and technical material.

Marvin Moran, a well known singer and radio personality, gave the coffee talk at the dinner. Mr. Moran's avocation is the collection of information concerning the sightings of unexplainable space objects and the subject of his talk was "Flying Saucers; Hoaxes, Hallucinations or Spaceships?".

After a short business meeting, **Ted Sobczynski** introduced **Royal C. Marshall,** design and color engineer for Ditzler Color Division of Pittsburgh Plate Glass Company, to the members of the Organic Section. Mr. Marshall spoke on the subject "How We See Color" and discussed the problems of color matching.

Kurt Hunsaker introduced **Christopher Marzano** to the Inorganic Section. Mr. Marzano, chief chemist of Amphenol-Borg Electronics Corporation, spoke on the subject "How To Plate Difficult Metals". He discussed the difficulties of plating on such metals as high silicon and aluminum bronzes, beryllium and tellurium coppers, and leaded brasses, and lead alloys, silicon, tantalum, titanium, molybdenum and every-day zinc die castings. In his talk and the ensuing discussion, he disclosed numerous treatments and methods of obtaining adherent plates on those metals.

L. Diveley
Secretary

NEWARK
Entertaining Program at Ladies Night

President **Al Korbelak** called the April 21 meeting to order at 8:30 p.m. at the Robert Treat Hotel with about 90 members and guests in attendance. Since it was Ladies Night, about 40 members brought their wives to the meeting.

The Branch was indeed honored by the presence of **Dr. Ernst Raub** from Germany and **Dr. Karl Schumpelt** formerly of Germany.

The membership voted to make the usual annual $25 contribution to the American Red Cross.

One application for membership was received and four were elected to membership.

Howard Cobb, Branch past president and one who had contributed much of his time and effort to the Branch, was elected to Honorary Membership.

Having dispensed with the business, the meeting was turned over to **Paul Oldam.** Paul amused us for about a half hour with his tricks of magic. Following this, Al Korbelak showed us slides of his recent trip to Japan, Australia and Hawaii. He presented his slides in an interesting and informative manner.

Paul Oldam then presented the Jarrets, mentalists, who spent the next half hour reading our minds, predicting the future and performing the arts of legerdemain. Both Al Korbelak and **Don Foulke** presented door prizes to the lucky ladies. At the conclusion of the meeting we partook of a light refreshment and renewed acquaintances.

Both the members and their wives felt that it was a very interesting and entertaining evening.

Gustav Bittrich
Assistant Secretary

NEW YORK
Miller Speaks on Buff Fabrics

The March 24 meeting was called to order by President **Joseph Rembecki.**

Motion made and carried that two applications for membership follow regular course.

Librarian **Martin Pollack** introduced **David J. Miller,** technical field representative of Deering Milliken Inc. and a member of the AES Research Project 18 Committee. Mr. Miller's paper "Engineered Buff Fabrics", covered manufacturing methods for making buffing fabrics. He started by describing the cotton fibers and continued with all the different tests, controls and processes used to develop a high quality buffing fabric. Special fibers are picked to give better absorption and wear of the buffs. Mr. Miller said that none of the synthetic fibers so far tested by his company can be used, due to their poor absorption and low heat resistance.

Following the question and answer period Mr. Miller received a vote of thanks from the members present.

Fred Saras
Recording Secretary

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NEW YORK
Old Timers Honored; New Officers Installed

The night of April 14 was "Old Timers Night" at the New York Branch. President **Joseph Rembecki** presided.

A motion made and carried that one application for membership follow regular course. Three men were accepted as members and duly sworn in by President Rembecki.

Dr. Donald G. Foulke of the Newark Branch installed the officers for the coming year: President, **Jack Weiner;** first vice president, **Arthur Carlson;** second vice president, **Isidore Friedman;** financial secretary, **Daniel Paris;** recording secretary, **Fred Saras;** librarian, **Walter Schwartz;** sergeant-at-arms, **Charlie Weiner;** secretary-treasurer, **Milton Nadel;** Board of Managers, Joseph Rembecki.

Milton Nadel presented outgoing President Rembecki a Past President pin and a gold wrist watch for his services to the Branch.

Dave Clarin was presented with a beautifully engraved plaque due him from the "Dave Clarin Night" for his work with the Branch and National Society.

Milton introduced all members who have been with the Branch over 25 years. He praised them for their work at the local and national levels. The senior member, **Justus E. Stremel,** is one of the founding fathers of the Society. All the Old Timers had a word of praise for the Branch and urged the members to take active parts and keep our Branch on top.

After the speeches by The Old Timers and other members honoring them, the meeting was adjourned. Refreshments and a magnificent buffet with entertainment were enjoyed.

Fred Saras
Recording Secretary

PHILADELPHIA
Parker Discusses Basis Metal in Precious Metal Plating

The regular meeting was held at Beck's Restaurant with 42 at dinner and about 60 at the meeting called to order by Branch President **Cogan** at 8:20. Following introduction of guests by First Vice President **Hauseman,** the minutes of the previous regular and Executive Group meetings were read by the secretary and approved.

Mr. Cogan announced Ladies Night would be held June 9 at the Melrose Country Club; golf facilities in the afternoon would be available; the dinner choice would be roast beef or lobster tail.

The treasurer's report was given and an interim financial report on the 1961 Banquet was heard. Three active members were admitted and one application for membership was received. It was reported that Member **William H. Moyer** was quite ill. The resignation of **George B. Valentine** from the Board of Managers was accepted.

William H. Trusdell gave the report of the nominating committee for candidates for the 1961–62 term. He also asked that serious thought be given to limiting the period of service for officers, other than secretary and treasurer, to one year and thus reduce the length of time of service for a member who starts as librarian and works his way through the vice presidents offices to president.

Librarian **Marsh** introduced **Dr. Edward A. Parker,** Technic, Inc., who spoke on the important role of the basis metal and its preparation in precious metal plating. Dr. Parker gave several examples, illustrated by slides, on how the quality and preparation of the basis metal affected the performance of subsequent deposits of precious metals, as well as less expensive metallic coatings.

I. Wm. Marcovitch
Secretary

PHOENIX
Brush Plating Presented by Olney

The March meeting was held at the Arizona Ranch House Inn, 5614 North Central Avenue, with 27 members, wives and guests present. After a roast beef dinner, **Floyd Huhn,** president, called the meeting to order.

Treasurer **Neva Johnson** reported that approximately $30 were cleared on the symposium.

Jim Weaver gave a report on the Los Angeles Symposium indicating that the Phoenix Branch should follow some of their planning on the next symposium.

The business meeting was followed by a humorous and entertaining talk by **Fred Olney** of General Electric which included a demonstration on brush plating.

Paul M. Wible
Secretary

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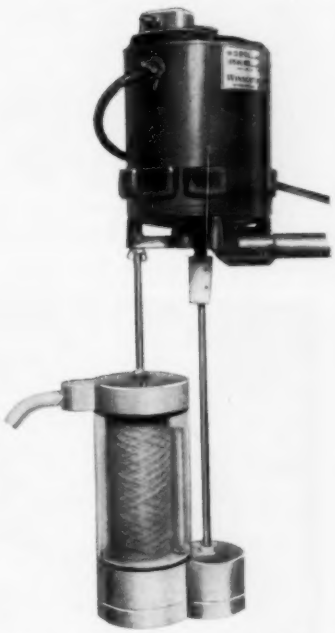

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PITTSBURGH
Faust Presents Paper at Meeting with Electrochemical Society

A joint meeting of the Pittsburgh Branch of the AES and the Electrochemical Society was held on April 12, at Gateway Plaza.

The newly elected officers of the Branch were introduced by President **Fred Stevens** followed with the introduction of the officers of the Electrochemical Society.

Two new members were elected.

Librarian **Walter Johnson** turned the meeting over to **Ed Smith** who introduced **Dr. Charles L. Faust** of Battelle Memorial Institute as the guest speaker of the evening.

Dr. Faust presented a very interesting talk on the subject of "Surface Metallurgy and Its Effects On Electrodeposited Coatings".

On May 10, the Branch will visit the new plant facilities of Robertshaw Fulton Controls Co. in Youngwood, Pa.

Our Annual Ladies Night will be held at Churchill Valley Country Club on Saturday, June 10, 1961.

Clyde A. Mungall
Secretary

PROVIDENCE-ATTLEBORO
INCO Film Shown

The March Meeting was held at the Engineering Building, Monday, March 20, at 7:30. The meeting was called to order by President **Dan Turner.**

The subject of the evening was a color movie produced by International Nickel, Inc. A technical film, it showed the very complex processes of recovering from tons of ore minute quantities of precious metals —gold, platinum, rhodium, etc.

In the short business meeting Dan Turner appointed **Granville Robbins** and **Sib Kershaw** to make arrangements for the Spring Frolic.

C. I. Healy
Secretary

PROVIDENCE-ATTLEBORO
Rinker Speaks on Gold Plating

The February 20 Meeting of the Providence-Attleboro Branch was held at the Engineering Building on Angell Street, Providence.

President **Daniel Turner** called the meeting to order at 8:00 p.m. and introduced the speaker **Edwin Rinker** of the Sel-Rex Corp. Ed's subject was "Bright Alloy Gold Plating."

As usual, when the talk is on precious metal plating, the audience is larger than is customary. In the past, this subject has almost brought on a heated discussion between the electroplaters and the rolled gold plate people, many of whom are members of the Branch. However, Ed with good humor and good tact pointed out that gold electroplate can even help out on edges and cut through ends.

A long question and answer period followed Mr. Rinker's talk. Sixty members and guests were present.

C. I. Healy
Secretary

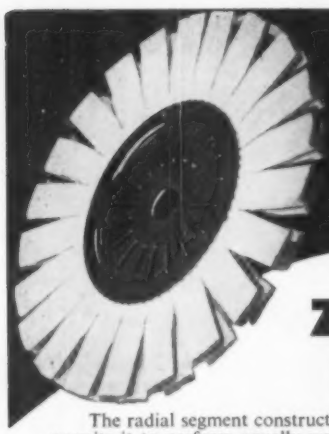
ROCHESTER
Meyer Presents Plating Room Hazards

The April 3 meeting of the Rochester Branch was called to order by President **John Cipolla. Jack Pandina,** chairman of the nominating committee, presented a slate of officers for the coming year. Two new members were elected to the Rochester Branch.

After the business meeting, Librarian **Loring F. Carson,** introduced **Dr. Walter R. Meyer**, president of Enthone, Inc., as speaker of the evening. Dr. Meyer gave an excellent and informative talk on "Hazards in the Plating Room". Dr. Meyer highlighted his talk by actual demonstration of reactions that could cause grave dangers in a plating room.

After the demonstration, Dr. Meyer distributed brochures of his talk which are available from the Enthone Co. They are excellent reading and should alert anyone in the plating industry to the hazards that can be caused through neglect and carelessness.

Peter VanDilst
Secretary



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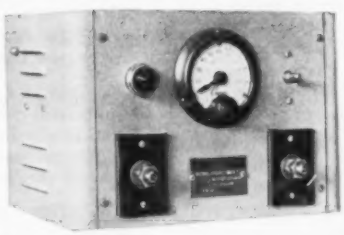

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SAGINAW VALLEY

Forum of Past Presidents; Weiss Discusses Membership

Saginaw Valley held its annual Past Presidents' Forum at its regular monthly meeting at Zehnders Hotel, Frankenmuth, Michigan, April 12. Before hearing a short talk by each of our past presidents, there was an exchange of gavels between outgoing President **Ray Gittens,** Electric Auto-Lite, and incoming President **Frank Reha,** Udylite Corporation. **Bud Weiss,** Metal & Thermit Corporation discussed the membership drive of the Society. The meeting was adjourned after the filming and narration by **Joe Kiss,** Mohawk Metal Forming & Tool Co., on Alaskan Big Game Hunting.

Pat Kehoe won the door prize, a radio donated by Metal & Thermit Corporation.

Bill Ross
Librarian

SOUTHEASTERN

Annual Officers Announced; Weymouth Reminisces

At the regular monthly meeting held at the Pig-N-Whistle in Atlanta on April 14 new annual officers were elected: President, **Vince Cashen;** first vice president, **Jerry LaChappell;** second vice president, **Roy Peterson;** librarian, **John Varner;** secretary-treasurer, **H. R. Stogner Sr.;** assistant secretary, **Robert H. Probert.**

Robert H. Probert was appointed General Chairman for the 4th Dixie Regional Technical Session to be held at the Dinkler Plaza Hotel in Atlanta, February 9–10, 1962. After dinner a charter member, past president and former secretary, **William R. Weymouth,** spoke briefly about some of the interesting events in the history of the 14-year old Southeastern Branch.

Robert H. Probert
Assistant Secretary

SPRINGFIELD

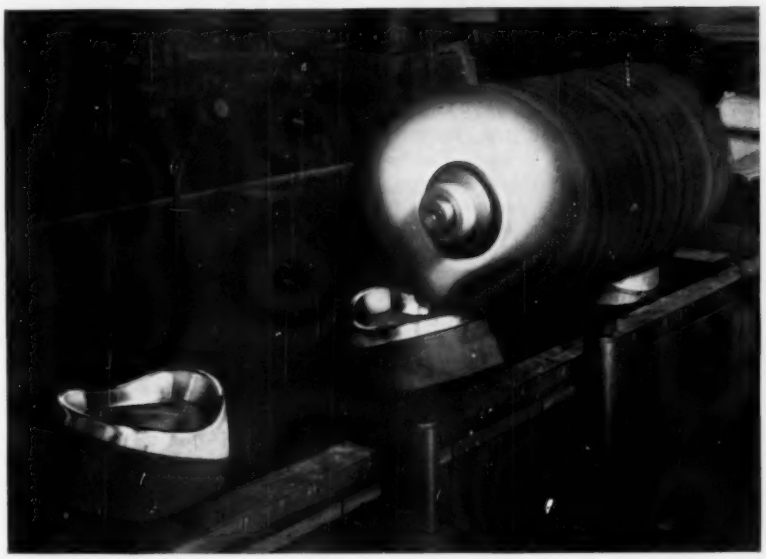
Keener on Vibrational Finishing; Prouty Death Announced

The Springfield Branch met at the Wayside Restaurant on Monday evening, April 24, for the regular monthly meeting. There were 31 members and guests present.

Elery Gibson, chairman of the Activities Committee gave a brief report on the 5th Annual Golf Outing, installation of officers and banquet which will be held at the Whippernon Club in Russell, on Saturday, June 10. He announced that tickets were available, and could be secured through **Al Salmond, Bob Girard, Roger Heroux, Pat Donaruma, Charlie Griffin** and **Wayne Sanders** as well as himself.

The Branch secretary announced the candidacy of **E. E. Oberland** of the Baltimore-Washington Branch for Third Vice President of the Supreme Society. From information available, he is running unopposed.

ACME IN ACTION



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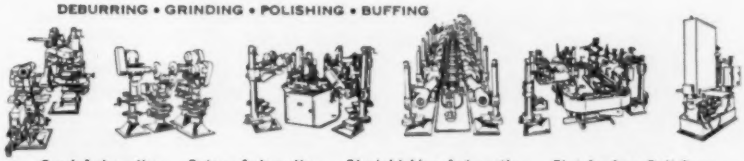

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President **Al Salmond**, as chairman of the Educational Committee of the New England Regional stated the meeting held the previous Saturday was the largest one ever held, with over 850 dinner guests. The two speakers, **Ralph E. Pettit** and **Alexander Korbelak**, were very well received.

Philip W. Prouty, one of the really old timers of the Springfield Branch, passed away on April 10. Phil had over 32 years in the Branch, was an Honorary Member, and was chosen to represent Springfield as the Branch Old Timer at the affair held in conjunction with the Eighth Interim Meeting in Hartford.

President Salmond thanked everyone for their cooperation and the fine job all the committees had done, to make this year such a successful one, and much easier for him.

Leo J. Diamond, technical chairman, introduced **Deane Keener** of Lord Chemical Company. Deane spoke on Precision Barrel Finishing by Controlled Vibration.

He explained many of the advantages of this type of finishing. Workload in this type of machine is 90 per cent of capacity, in comparison to 60–65 per cent in conventional barrels. Ratio of parts to media is about double of standard barrels. One vibrator is capable of doing about the same amount of work as ten or more conventional barrels, as well as finishing the interior and shielded areas in the same operation, thereby reducing greatly the number of pieces of equipment, and the number of operations. In addition, due to the open top, there is ease of inspection while the process is in movement. Operation costs are drastically reduced, and maintenance costs are cut, due to the simplification of construction.

Henry L. Heissfeld
Secretary

TORONTO
Korbelak Presents Paper on Precious Metal Plating

Reporting on the success of the Toronto Branch's Technical Symposium held March 28, **Herb Skelton** told members at the general meeting in the Royal York Hotel, April 14, that attendance at the event surpassed the 200 mark. He further stated that the committee responsible had received many congratulations on the preparations and staging of the affair, which was a "first time" effort by the Branch.

An attempt to obtain copies of the various speakers' papers for distribution to those desiring same, is being made, he said. Herb concluded by stating that he did not feel the Branch would lose money but rather that it would break even on the symposium.

Brock Laws noted that nine of the pictures taken at the Symposium had been submitted to the National Executive Secretary, J. P. Nichols, who had written indicating three or four would possibly be used to illustrate his report of the affair which will appear in a future issue of the Society's magazine, PLATING.

Two new members were accepted into the Branch.

A motion by **Ray Day**, seconded by **Al Adams**, that **Des Newman, John Buchan, Murray Janes** and **Earl Knight**, be nominated for the executive, was carried, and said members were subsequently elected.

Speaker of the evening, **Al Korbelak**, delivered a very interesting talk on "Jet Age Precious Metal Plating".

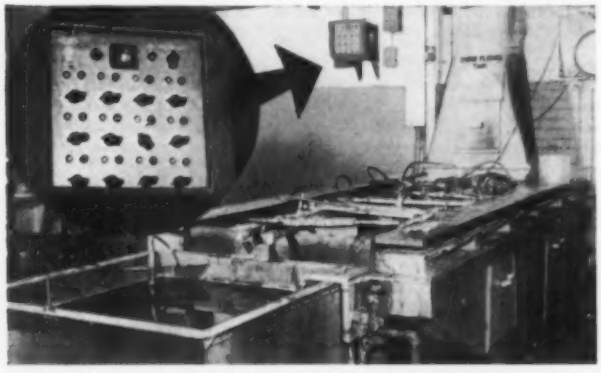
Brock Laws

WATERBURY
Meyer Presents Paper; School Lectures Started

The Waterbury Branch held its regular meeting at the Roger Smith Elton on Thursday, April 13. President **William Giesker** announced that the 22nd New England Regional Meeting is entirely sold out. Approximately 200 people will represent the Waterbury Branch.

The Branch initiated a new member and presented him with a certificate of membership.

The Branch's program to present lectures to local schools has gotten under way. The first such lecture was presented by **Henry Strow** at the Swift Junior High



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School in Watertown. **Edward Garland** presented the second lecture at the Naugatuck High School.

The nominating committee brought in its report and the following members were nominated for office: President, **Louis Porretti;** first vice president, **Patrick Mazzamaro;** second vice president, **Francis A. Schneiders;** librarian, **Clarence Foster;** secretary-treasurer, **James Kennedy.** Additional nominations are in order before the next meeting when the election will be held.

Technical Chairman Francis Schneiders introduced the speaker of the evening, **Dr. Walter Meyer.** Dr. Meyer presented an excellent paper on "Hazards in the Plating Room". He discussed the causes of serious accidents, explosions, fires that have occurred in plating rooms and other potential hazards. Dr. Meyer actually performed experiments showing the combustible nature of many materials and the dangers of mixing oxidizing and reducing materials.

Francis A. Schneiders
Publicity

WESTERN ONTARIO

Rectifiers Discussed by Scott

The April meeting was held at the Wm. Pitt Hotel, Chatham, with 25 members and guests present. President **Jim Kelly** presided. A short business session followed dinner after which **Earl Patterson** introduced the guest speaker, **R. Scott,** Dresser Electric Company, Detroit, Michigan. Mr. Scott gave a brief outline on rectifiers and then, rather than contain his vast knowledge in a talk, he asked the floor for questions. This developed into a very interesting presentation as it got right to the bottom of the average platers problems in the rectifier field.

Yon Shimizu thanked Mr. Scott for his very beneficial talk.

Bob Dobson
Vice President

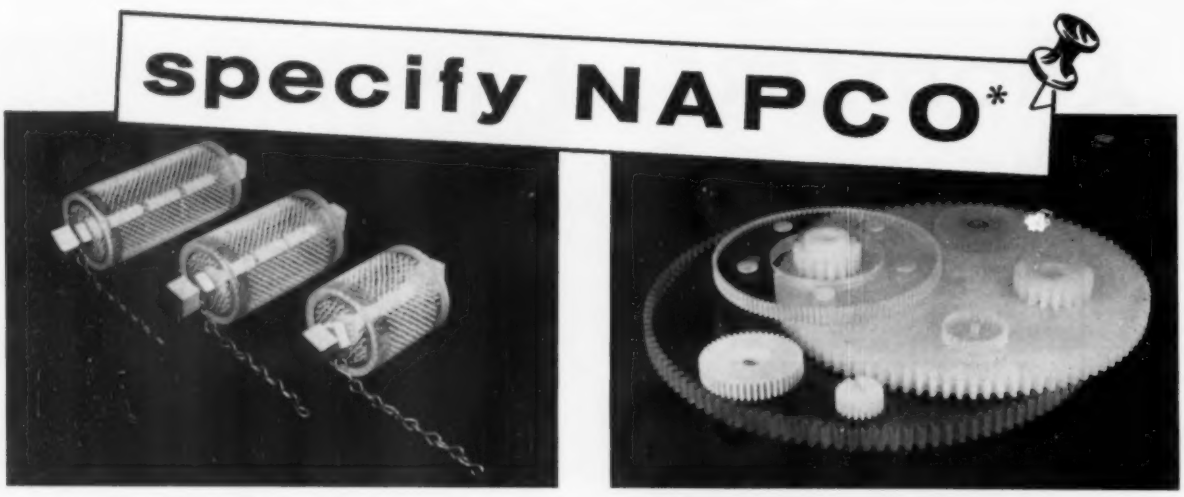
BRANCH EDUCATION

AT BRITISH COLUMBIA

Certificates were presented at the Branch meeting on April 21 to the students who had successfully completed the night school classes in electroplating. The six-month course held at the Vancouver Technical School was again conducted by Walter Kellerman, a member of the British Columbia Branch.

AT NEWARK

A highlight of the May regular meeting of the Newark Branch was the presentation of diplomas to the graduates of the electroplating school conducted by the Branch under the direction of F. J. LaManna. This year 29 students completed the 14-week course held at various plants and laboratories throughout the Newark area. Each subject is taught by an expert in the particular field—a member of the Branch connected with the plant being visited by the class. The awarding of the diplomas was made by Mr. LaManna.



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H. Pochapsky Instructor
15-wk. course—Fee: $11

INDIANAPOLIS, IND.—Purdue University Extension
Dr. A. M. Max, Instructor
16-wk. course—Fee: $45

MONTREAL, QUE.—Polytechnique Institute
Dr. Andre Hone, Instructor
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Walter Kellerman, Instructor
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Any such paper accepted and published in PLATING will also be eligible for selection by the Society's Paper Awards Committee for the Carl E. Heussner AES Gold Medal Award; AES Silver Medal; AES Bronze Medal; George B. Hogaboom Memorial Nickel Plating Award; Robert S. Leather Mechanical Finishing Award; Chromium Plating Award; Precious Metal Plating Award of AES; John J. Hanney Memorial Copper Plating Award; Organic Finishing Award; Zinc Plating Award and the Aluminum Finishing Award of AES.

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Compilation of ASTM Standards, Soaps and Other Detergents, D-12, 272 + VIII pp. Nonmembers $4.25, AES Members $3.85.

The 1960 edition of the COMPILATION OF ASTM STANDARDS ON SOAPS AND OTHER DETERGENTS, published by the American Society for Testing Materials, is now available. The volume contains 24 specifications, 23 methods of test and a set of definitions. Three new methods for the analysis of synthetic detergents have been added and the other standards have been revised and brought up-to-date since they were published in the previous edition of 1959.

Also included are new proposed methods for the rapid determination of solids by infrared moisture balance and for measuring redeposition of soil on cotton fabric.

Typical Contents: Spec. For Salt-Water Soap, Spec. for Sodium Sesquisilicate, Spec. for Compound Powdered Soap (Granulated, with Rosin), Chemical Analysis of Industrial Metal Cleaning Compositions, Total Immersion Corrosion Test for Soak Tank Metal Cleaners, Test for Rinsing Properties of Metal Cleaners, Aerated Total Immersion Corrosion Test for Metal Cleaners, Testing Detergent Alkylate, Test for Buffering Action of Metal Cleaners, Chemical Analysis of Sulfonated and Sulfated Oils, Sampling and Chemical Analysis of Alkaline Detergents.

Mechanical Polishing, by Walter Burkart English translation from the German edited by Harold Silman with additions by Charles R. Draper. 267 pp. Nonmembers $9.25, AES Members $8.25.

MECHANICAL POLISHING is a detailed account of polishing, buffing and other mechanical finishing processes as they are now being used in Germany, England and the United States. This book may be divided into three sections. The first chapter on the general principles of the processes involved concerns itself with the theoretical and practical aspects of these operations. The next four chapters describe the physical equipment needed to perform these operations. The concluding four chapters review the various procedures used in mechanical polishing and methods are outlined for finishing a great variety of materials.

The first section discusses the different theories held concerning the procedures needed to bring metals up to a high lustre. The authors do not take a positive stand on the issue, but rather they seem to believe that some metal flow does take place as well as some cutting. After some discussion about the dislocation of metal, the authors show that they are considering the whole problem when they say, "All things considered, it is not surprising that grinding and polishing are often at the root of plating troubles." After the theoretical discussion the practical side of the problem is reviewed in rather general terms that serve as a guide for the rest of the book. Also, in this chapter, is a section dealing with the laboratory equipment used in surface measurement; such as the stylus surface recording instruments, the interference microscope, the electron microscope, and photo electric gloss recorder.

The second section begins by describing the important abrasives used in the industry and covers their pertinent properties. Dust control and health consideration of the abrasive materials deserve and receive adequate attention in this chapter. The principal wheels or mops used in industry are covered in the second chapter of this section. Directions are given for their use. The optimum surface speed for the wheels for grinding and polishing (in the United States, polishing and buffing) is given as 600–900 feet per minute for metals, and is obviously in error and should be corrected. Speeds for finishing plastics are also noted and are of the same order. These values do not correlate with data developed in following chapters. The paragraphs on the amount of metal removed by various operations are quite practical and seemed to be based on wide factual experiences.

The chapter on machines makes use of a large number of photographs to develop a most compete story of the various pieces of equipment, both manually and automatically operated used to polish and buff various parts. Proprietary names are freely mentioned and would be of great use should it be desired to follow a suggestion that seemed beneficial. The shorter part on automatic compound applicators is written along the same lines. The physical layout, fire hazards, operator hazards, product design and fabrication problems, and costing also are briefly discussed in this chapter.

The final chapter in this section covers media, or stated another way, the binders which hold the abrasives to the wheel. Here the material is of a rather general nature. No specific formulas are given but rather the various types of compounds are mentioned and the recommended methods for handling them are given. Considerable space is given to a discussion on the handling of liquid compounds.

The third section begins with a chapter on polishing methods and mentions the various methods of polishing and buffing that do not involve the use of a wheel. Belt polishing and buffing are discussed quite fully as well as scratch brushing and satin finishing. Lapping, honing, superfinishing, dry grit blasting, wet blasting are also discussed. However, barrel finishing or tumbling constitutes the main portion

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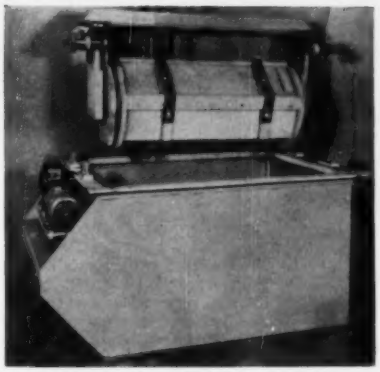

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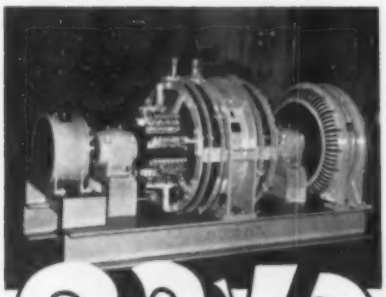

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of this chapter and includes a large amount of detail as to equipment, operation, compounds, and tumbling media. The chapter concludes with a short and inadequate section on chemical and electrolytic polishing. However, this should not be included in the scope of this book.

The concluding three chapters outline specific procedures for polishing and buffing various metals (iron, brass, bronze, zinc, aluminum, magnesium, precious metals, pewter, nickel, silver, and electrodeposits, plastics, wood, lacquers, ivory, horn, mother of pearl, glass, and precious stones). In the above area the book has some weaknesses. A page and a half covers steel, a page is given to zinc die castings but five pages are used to discuss the polishing and buffing of aluminum and magnesium. Certainly this is not logical based on the usage of the metals under question.

The book certainly exhibits the freer flow of information that now exists between the European Continent and the United States and points up the need for a glossary of metal finishing terms that would be acceptable on both sides of the Atlantic Ocean. Having 205 photographs, the volume is very profusely illustrated and generally speaking the whole work is very well done and would be a worthwhile addition to anyone's library if there is the slightest interest in metal finishing.

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AES LAPEL BUTTONS

The AES member's handsome sterling silver lapel button can be purchased from your Branch Secretary at $1.38 per button including tax. These, in turn, can be purchased by Branch Secretaries from National Headquarters at that amount. The silver Branch Past President's button can be purchased by Branch Secretaries from the National Office at $1.43 per button including tax.

For cleaning these sterling silver buttons, here is one expert member's reported method, "Place hot water in which a little washing soda has been dissolved into an aluminum pan or any container with a small piece of aluminum at bottom (concentration: one tablespoonful of soda to one quart of water). Immerse the button so as to touch aluminum, and allow to soak until tarnish disappears. Operation will clean but will not injure the silver."

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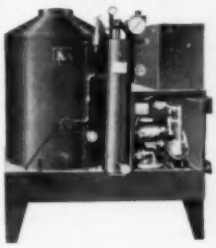

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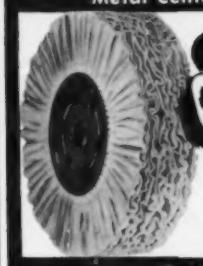

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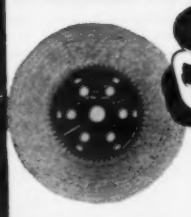

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SILVER ANNIVERSARY OF ILLINOIS INST. OF TECHNOLOGY

Twenty-five years of scientific research for industry and government was celebrated April 6, by Armour Research Foundation of Illinois Institute of Technology and plans were made to make the silver anniversary celebration a year-long event.

From a modest beginning in a few basement rooms at Armour Institute of Technology in 1936, the Foundation has grown to a seven-building complex on Technology Center, the campus of Illinois Institute of Technology at 35th and State Sts. From two research projects valued at $40,000 during its first year of operation, the Foundation has become one of the largest research organizations in the world. Research volume for the fiscal year ending last August 31 totaled $16.5 million.

The silver anniversary celebration will continue through May of 1962, according to Dr. Haldon A. Leedy, ARF director, and will include dedication of a new $3.5 million chemistry research building and a $1.2 million mechanics research building extension; a special three-day symposium involving some of the best known scientists in the world, and other scientific events to be announced during the anniversary year.

The Foundation has nine research divisions covering most of the physical sciences and related technologies: chemistry, physics, electronics, mechanics, metals, ceramics, fluid dynamics and systems, techno-economics and international.

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Only "Help Wanted" and "Situations Wanted" will be accepted. Rates: $.20 per word, minimum $5.00. AES Branch Members and Members-at-Large only, in good standing, are entitled (for personal use only) to a total of three free advertisements in any twelve-month period as of first insertion. Last day for inserting advertisements is the 10th of month preceding date of publication. When answering advertisements please address as follows: Box number, PLATING, 445 Broad Street, Newark 2, N. J.

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June 10, 1961—**Springfield Branch,** Annual Golf Outing, Installation of Officers and Banquet, Whippernon Club, Russell, Mass.

June 18-23, 1961—**48th AES Annual Convention,** Hotel Statler, Boston, Mass.

July 22, 1961—**Detroit Branch Annual Stag Day,** Glen Oaks Country Club, Farmington, Mich.

December 1, 1961—**Melbourne Branch Annual Dinner,** Melbourne, Australia

December 1-2, 1961—**Detroit Branch Annual Educational Meeting and Banquet,** Statler-Hilton Hotel, Detroit, Mich.

Dec. 15-16, 1961—**Newark Branch Annual Educational Session and Banquet,** Robert Treat Hotel, Newark, N. J.

January 13, 1962—**Ninth Interim Meeting, Supreme Society,** Hotel Marott, Indianapolis, Ind.

January 20, 1962—**Grand Rapids Branch Annual Meeting,** Pantlind Hotel, Grand Rapids, Mich.

January 27, 1962—**Chicago Branch Annual Educational Meeting and Banquet,** Conrad Hilton Hotel, Chicago, Ill.

February 9-10, 1962—**Fourth Annual Dixie Regional Educational Meeting,** Dinkler-Plaza Hotel, Atlanta, Georgia

February 17, 1962—**New York Branch Annual Technical Session and Banquet,** Hotel Statler-Hilton, New York, N. Y.

March 2-3, 1962—**Philadelphia Branch Annual Educational Session and Banquet,** Benjamin Franklin Hotel, Philadelphia, Pa.

April 21, 1962—**23rd Annual New England Regional Meeting,** Hotel Statler, Hartford, Conn., Springfield Branch, Host.

May 1, 1962—**Central Michigan Branch,** Annual Educational Session and Banquet, Hotel Hayes, Jackson, Mich.

June 25-28, 1962—**49th AES Annual Convention,** Schroeder Hotel, Milwaukee, Wis. Sponsorship Midwest Regional Council.

June 24-27, 1963—**50th AES Annual Convention,** Ambassador Hotel, Atlantic City. N. J. Sponsorship Newark Branch.

June 15-18, 1964—51st AES Annual Convention, Sheraton-Jefferson Hotel, St. Louis, Missouri.

June 16-18, 1964—Sixth Industrial Finishing Exposition, St. Louis, Missouri.

June 28-July 1, 1965—52nd AES Annual Convention, Statler Hotel, New York, N. Y.

June 26-30, 1966—53rd AES Annual Convention, Hotel Fontainebleau, Miami, Florida. Dixie Regional Council, Sponsor. Southeastern Branch, Host.

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June 16-19, 1961—National Association of Metal Finishers, Annual Convention, Statler-Hilton Hotel, Boston, Mass.

June 18, 1961—Metal Finishing Suppliers' Association, Board of Trustees Meeting, Statler-Hilton Hotel, Boston, Mass.

June 19, 1961—Metal Finishing Suppliers' Association, Annual Luncheon and Meeting, Statler-Hilton, Boston, Mass.

June 25-30, 1961—American Society for Testing Materials, Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J.

June 26-27, 1961—American Vacuum Society, 5th Annual Conference on Vacuum Metallurgy, co-sponsored by New York University, at University Heights Campus of N. Y. U.

July 31-Aug. 4, 1961—Gordon Research Conference on Electrodeposition, Tilton School, Tilton, N. H.

October 1-5, 1961—The Electrochemical Society, Fall Meeting, Hotel Statler, Detroit, Mich.

October 16-19, 1961—2nd International Congress on Vacuum Technology, Sheraton Park Hotel, Washington, D. C.

October 23-27, 1961—43rd National Metal Exposition & Congress, Cobo Hall, Detroit, Mich.

Jan. 30-Feb. 2, 1962—Society of Plastics Engineers, 18th Annual Technical Conference, Penn-Sheraton Hotel, Pittsburgh, Pa.

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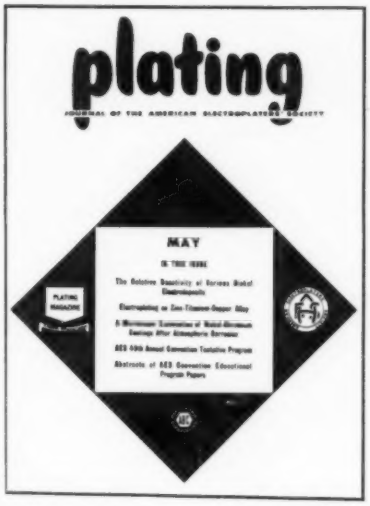

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INDICATE A 564.➤

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ANSWER:
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"How can wire plating be speeded up?"

ANSWER:
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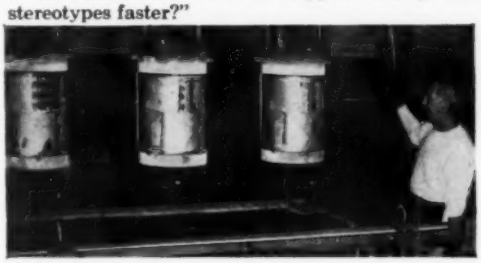
"What can be done to make rugged nickel-plated stereotypes faster?"



ANSWER:
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"What coating will best protect vital engine parts during break-in periods?"

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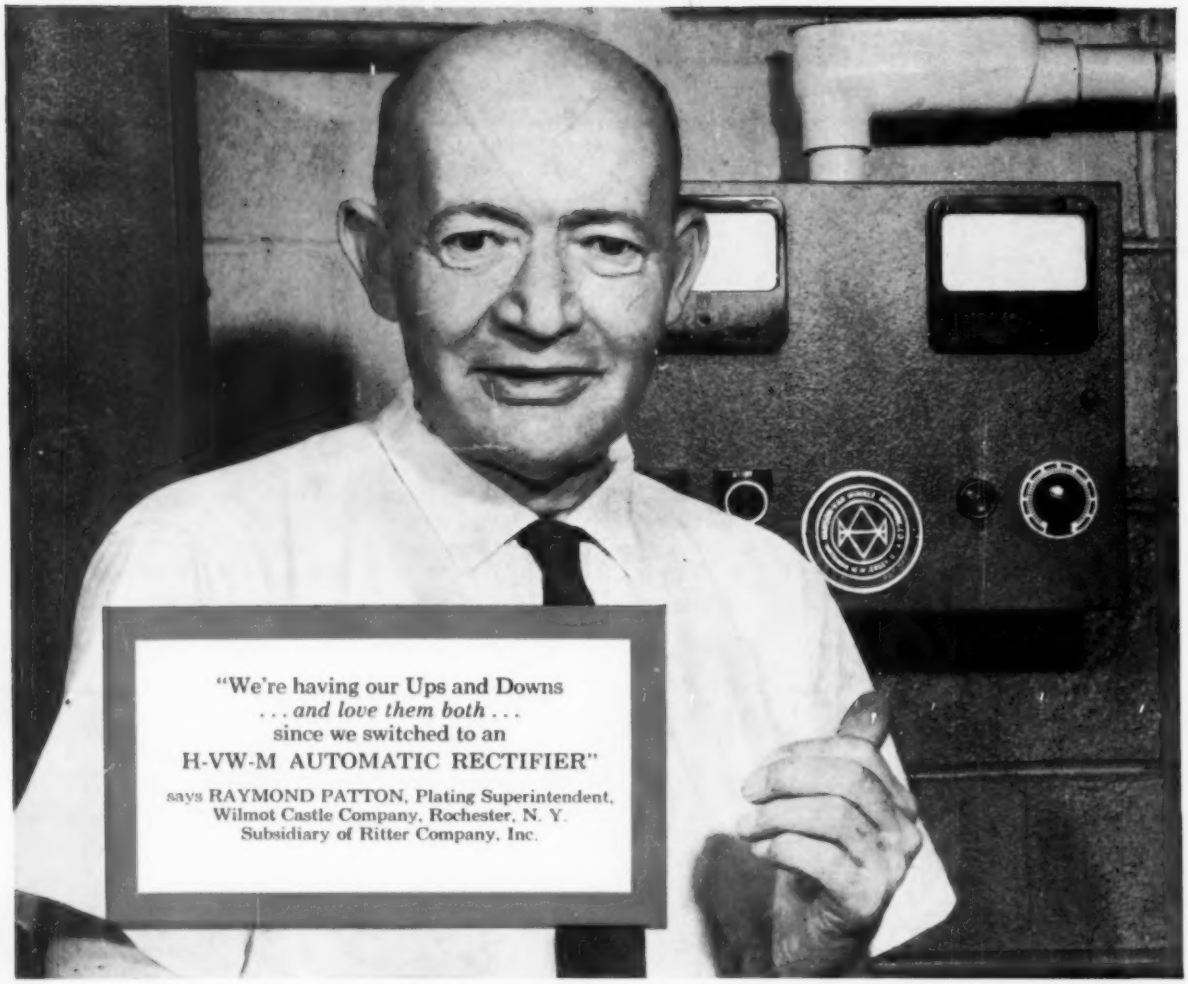
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says RAYMOND PATTON, Plating Superintendent,
Wilmot Castle Company, Rochester, N. Y.
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DOWN 25-30% go dial manipulations

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